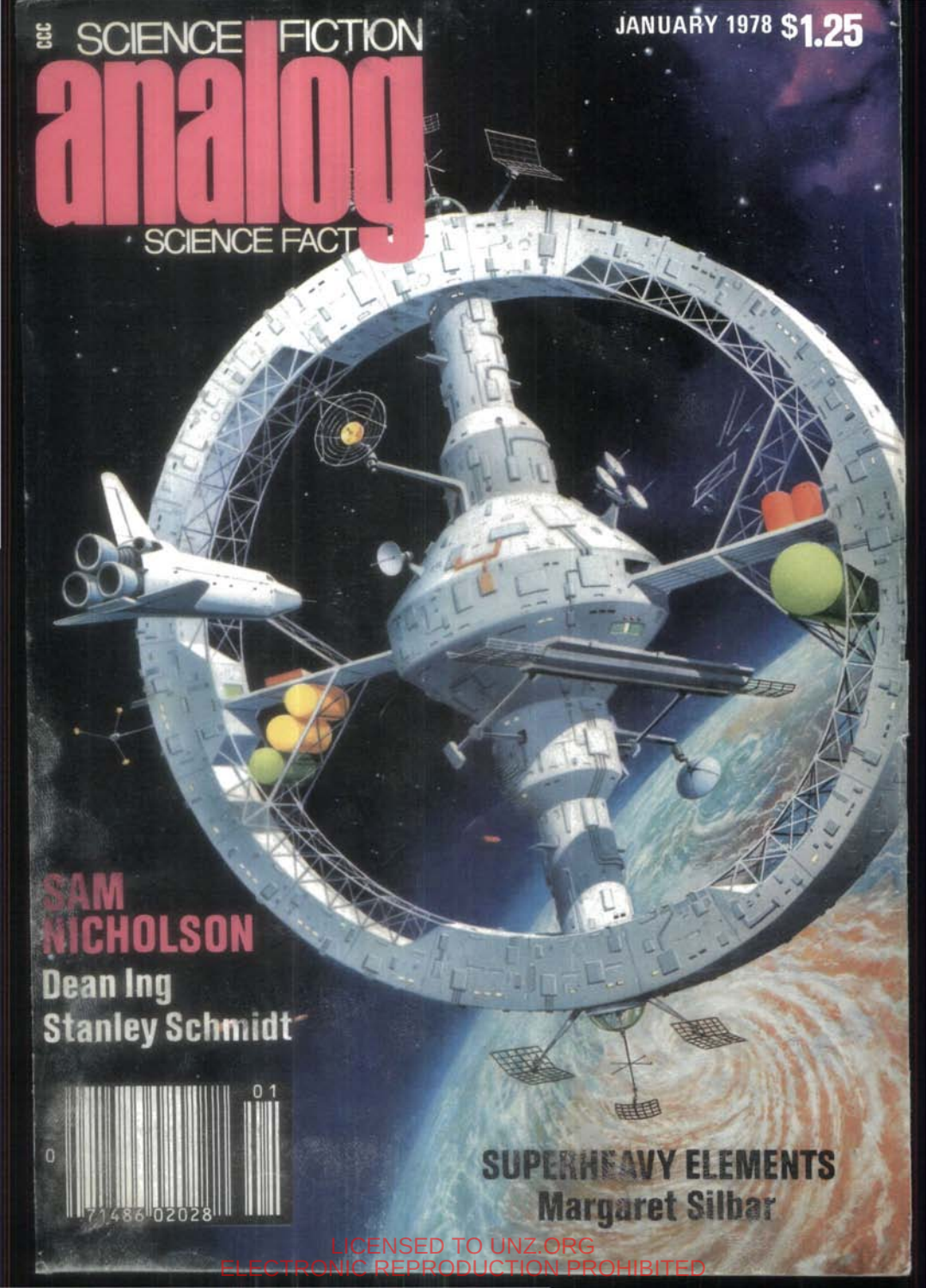

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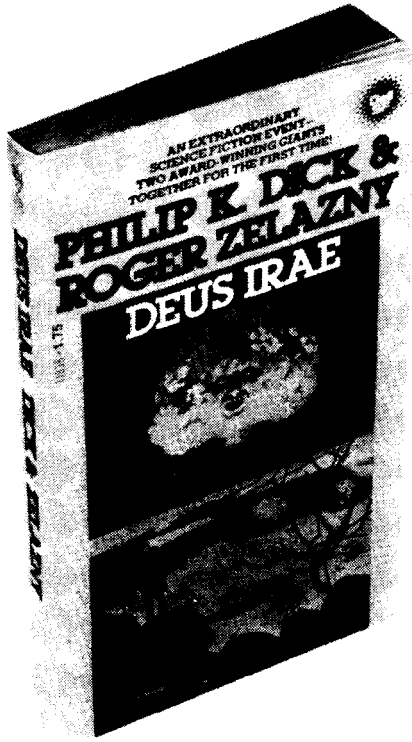
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SCIENCE FACT

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editorial courage

In that wonderful old film, *The Wizard of Oz*, Bert Lahr sings a song called, "Courage." As the Cowardly Lion, he was seeking courage, an estimable trait which he described thusly:

"What makes a king out of a slave?

"Courage!

"What makes a flag on a mast wave?

"Courage!"

And so forth.

Courage is a quality that we usually think of in association with grave physical danger: courage, heroism, bravery—these are the qualities we seek in warriors, leaders, men and women who risk their lives in battle.

But people can show courage in much more peaceful pursuits. And the lack of courage, when it comes from a bureaucrat or an office worker, can be just as devastating as cowardice in a soldier. The only difference is, it is rarely noticed or punished.

Take the matter of censorship, for example.

Everything you read (even in Analog) is preselected for you by editors, reporters, publishers, writers, copy-editors . . . sometimes even a clumsy-fingered printer will have more to say about what you read than you realize.

Back in 1950, I wrote a science fiction novel. It's title is not significant, because it never got published. Like most first novels, it was so poorly written that it's probably a mercy that it was never published. But that wasn't the reason for its consignment to editorial oblivion. Not the entire reason, at least.

The novel dealt with a typically silly science fiction premise; typically silly for the very early 1950s, that is. The basic idea was that, sometime in

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the incredibly distant 1970s or 80s, the Russians would be far ahead of the Americans in space experiments. The Reds would have artificial satellites in orbit around the Earth, and American intelligence suspected that they were planning a manned landing on the Moon. With incredible effort, America put together a crash program that successfully put an American on the Moon ahead of the Russians.

I had, in essence, predicted the Space Race of the sixties.

But publishers showed no interest in such a book. As most new writers do, I thought they were simply telling me that the writing was lousy, and/or the idea was ludicrous.

But then one editor showed a tiny amount of courage. He told me, "Look, this is no worse than a lot of the fiction we publish, as far as the writing is concerned. It needs work, of course, but you can improve it. The trouble is," and he grimaced, "there's this Senator Joe McCarthy rampaging around the country. He'd come down on us hard for publishing a book that suggested the Russians could get into space before we could."

Senator Joe was finding Communist plots all over the place, you see, and denouncing anyone he chose to denounce for being "soft on Communism." He finally took on the U.S. Army while General Eisenhower was President, and that broke him. But before that happened, he unknowingly scuttled my first novel.

No publisher had the courage to put out a novel that they thought might be noticed unfavorably by Senator McCarthy.

It was no great loss, literarily. And after a quarter-century I finally did publish a much-changed descendant of that first novel, under the title *Millennium*.

But the experience sent me scurrying into history books to see what our Founding Fathers had said about censorship. They wrote a First Amendment into the Constitution that guarantees "freedom of the press." But their arguments about freedom of the press included very detailed discussions of the perniciousness of censorship. One of the discussions went this way:

If an official censoring system is set up, not only will it tend to prohibit publication of the government's mistakes, but it will discourage publishers from even thinking about printing things that the government would frown on. This kind of precensorship is the deadliest censorship of all, because it means that "unpatriotic" ideas will never see print. It's one thing for the government to impound books or pamphlets it doesn't like; it's quite another for publishers to refuse to print something because of their fear of the government's reaction to it.

Well, McCarthyism died in the fifties and all is well.

Oh yeah?

Last year, I was approached by an organization called the Children's Book Council to write and then nar-

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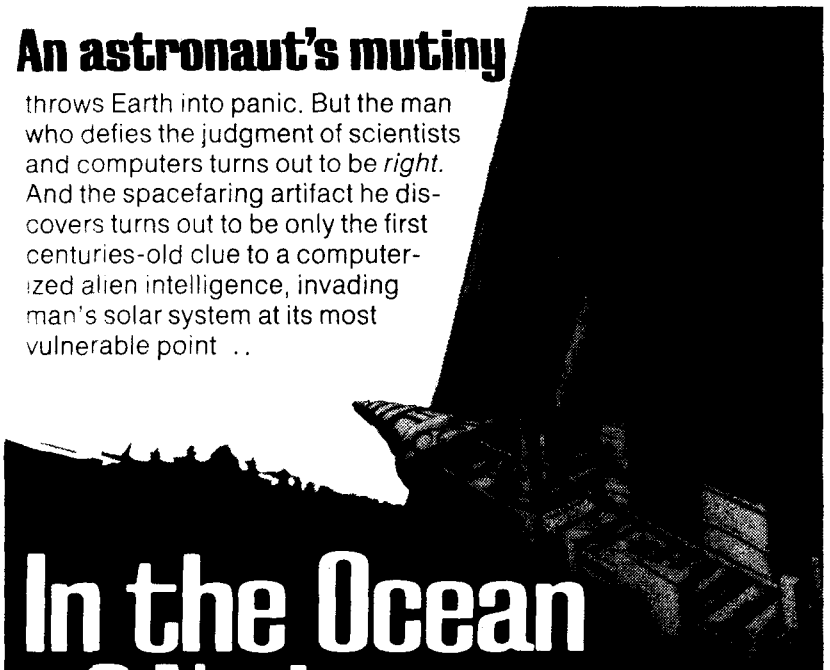
An astronaut's mutiny

throws Earth into panic. But the man who defies the judgment of scientists and computers turns out to be *right.* And the spacefaring artifact he discovers turns out to be only the first centuries-old clue to a computerized alien intelligence, invading man's solar system at its most vulnerable point . .



In the Ocean of Night

GREGORY BENFORD

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rate an audio tape for school teachers, on the subject of—what else?—science fiction. The Children's Book Council (CBC) is a private, nonprofit organization aimed at promoting children's books, especially in schools and libraries. In essence, CBC helps publishers to sell children's books.

Over the course of several months, working with one of CBC's consulting editors, I wrote a script for a half-hour-long presentation. First the outline was reviewed, commented on, rewritten, and finally approved. Then the script itself was reviewed and okayed, with a couple of minor quibbles.

One of the quibbles was about the following paragraphs:

In 1940, Heinlein wrote a novelette called "The Roads Must Roll." The story dealt with a cross-country network of moving roads—gigantic conveyor belts that carried cargo and passengers across the U.S. The plot of the story dealt with a strike by the engineers and technicians who run the roads, a strike that could cripple the whole nation.

Heinlein's technological prediction was nonsense. We don't have rolling roads. But we do have interstate highways, and the socio-political predictions in Heinlein's story were uncannily prophetic. He showed that once an efficient, convenient network of interstate roads was completed (no matter what their gadgetry) the major cities of the United States would begin to sprawl out along those roads. And the people who controlled those roads—such as our modern-day truckers and Teamsters Union—would gain enormous political power all across the nation.

It was that line about the Teamsters that got CBC upset. Their editor suggested to me that I drop the reference to the union. I demurred, saying that there was nothing inaccurate or derogatory about the line—it was simply a statement of fact. I read my script as written, and the tape was made on one sitting. Everybody was happy.

Except the man who gives legal advice to CBC. He wrote:

Dear Ben:

As I mentioned when we chatted briefly the other day, I think your SF tape . . . is terrific. Alas, we do have a problem with your allusion to the Teamsters Union . . . in my judgment, this is an actionable statement. I understand and appreciate your strong feelings on this matter, but the fact is that the Children's Book Council is in the business of promoting interest in children's books, not making our lawyers rich in a possible suit against us. . . . Frankly, we don't have either the inclination or the funds to get involved in court action as a result of this tiny libelous allusion.

He suggested that: (a) I grant CBC permission to snip the offending words from the tape; or (b) I sign an agreement to the effect that I would bear all legal costs if anybody sued them;

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or (c) I return to the recording studio and dub in a softer line.

Shaking with righteous wrath at this precensorship, I suggested in a return letter that they either take my words as I wrote and spoke them, or drop the whole project.

His response was also heated:

Dear Ben,

Thanks for letting me know how you stand about the Children's Book Council's interest . . . in creating more support for children's books. I guess it's more important to you to make a statement through and at the possible expense of the Council about a . . . Teamsters Union than it is to help teachers, librarians, etc. As we all respect you, of course we won't use your . . . tape. I'm sorry about that, because in every other respect I think it's terrific.

Note the elipses in the quotations from his letters. They are necessary here because his statements about the Teamsters Union were unkind enough to be considered libelous by an unbiased lawyer. I never suggested that the Teamsters were anything other than politically powerful. I wrote back, suggesting that he was reading evil tidings into my script that simply were not there. I further suggested that he contact the Teamsters' legal counsel, and see what they thought of the tape. I also advised him to read Thurber's "The Male Animal."

We exchanged a couple of more letters, with neither side budging from its position. I took the liberty of calling the Teamsters International office in Washington. I spoke with a Mr. Allan Biggs, of the public realtions department. He listened to my paragraph politely, then complained:

"We don't *control* the roads. The state legislatures and the big companies control them."

No complaint about insulting the Teamsters' honor or about the reference to their political power.

And that's where the matter stands. Several months of work (both mine and CBC's) have been wasted. I was paid for the work, of course, but that's scant consolation for a tape that will never be played to its intended audience.

Precensorship. Bowing down before the boss. Doing unto yourself before he does it unto you. The next time you begin to grumble about some investigative reporter's exposure of crime or corruption, get down on your knees and thank God that there are still some publishers who have the courage to report the news as it happens. Don't blame the messenger for the bad news. As Bert Lahr put it:

"What makes the Hottentots so hot?

"Courage!

"What have they got that I ain't got?

"Courage!"

There are a lot of Cowardly Lions sitting behind desks in every city of the world. The real trouble is, they don't even *want* to find their courage.

THE EDITOR

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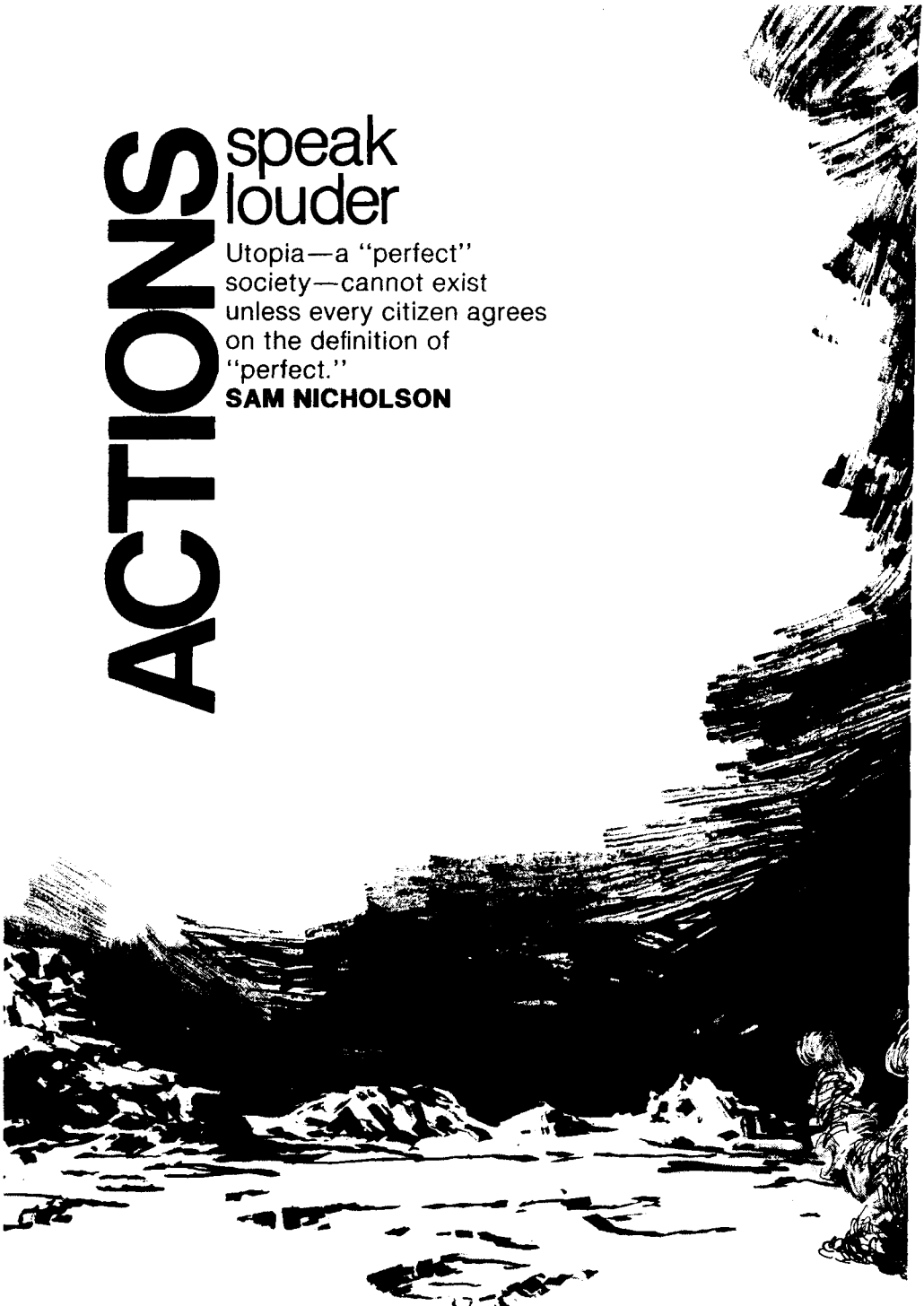
ACTIONS speak louder

Utopia—a "perfect" society—cannot exist unless every citizen agrees on the definition of "perfect."

SAM NICHOLSON



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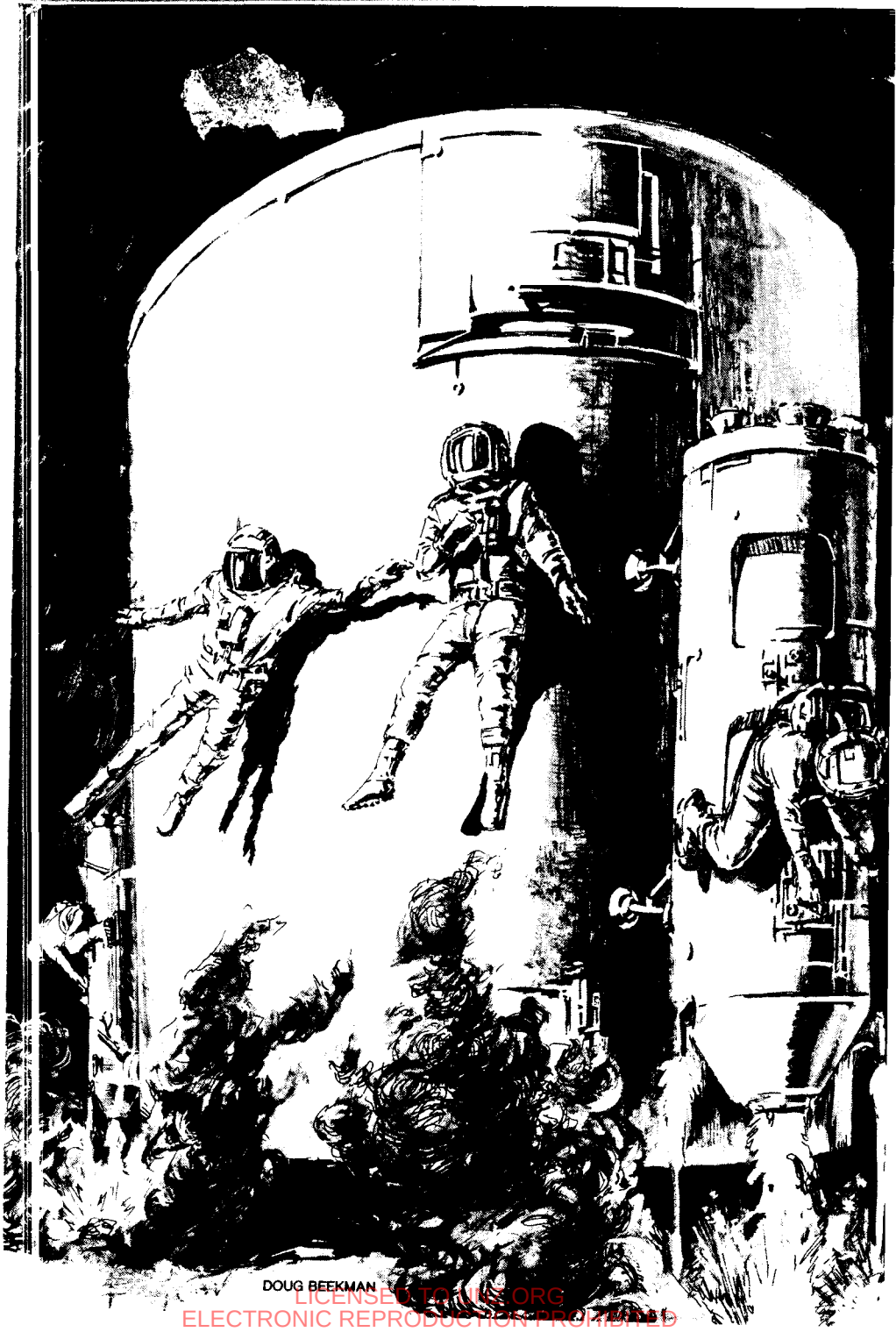

DOUG BEEKMAN

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If I was the guy calling the shots for my shipowners, I would keep myself working at sea, year in and year out. Schuster, the Flying Dutchman. But the docs have to get into the act and haul me ashore once a year for a vacation.

Sometimes I can finagel Mickleberry in Operations into keeping me afloat a few weeks longer. On this particular winter day, I was optimistic because Mickleberry himself had called me to his office after I had finished my troubleshooting assignment aboard a liquid gas tankship. I figured he had another job too dirty for anybody else.

I was right—but not in the way I had thought.

I dropped my suitcase beside the receptionist's desk and barged into Mickleberry's office. He waved me to a chair. His parched face gave me a thin smile. He began,

"I assume, Captain Schuster, you are aware of the Company's recent investment in Space Mining, Incorporated?"

"Yeah, sure," I said cautiously. I plow a percentage of my salary back into Company stock, and I had read about Space Mining in the latest quarterly report.

"The investment was made on the assumption that Space Mining would move into action on the Moon, as soon as the various government licenses were granted," continued Mickleberry in his dry voice, "but all licenses were in order several weeks ago, and no action has been forthcoming."

"They're developing difficult real estate."

"They are nowhere near an approach to the real estate." Mickleberry placed his fingertips together. "Since our medical department has recommended that you be relieved of sea employment for six weeks, Captain Schuster, Mr. Bennington is requesting that you look into the Space Mining delay."

"Me!" I barked, surprised. Bennington was the Company's Chairman of the Board. Until that moment, I had thought he was a smart businessman. I went on, "I don't know a goddamned thing about space!"

"The issue is not space but a bureaucratic bottleneck. The launching site at Cape Canaveral—and you will kindly, while in Florida, refer to the Cape as Canaveral, not Kennedy—as I say, the launching site is ready and waiting. The subcontractors are meeting their delivery deadlines—"

I interrupted, "NASA is providing a dockyard?"

He winced. "Not dockyard, captain. Space Mining has leased ground on the government reservation for their ALC."

"ALC?"

"Assembly/Launch Complex."

"And Bennington thinks I can get the SOBs off their ASS?"

Mickleberry choked briefly. "You are an expert in—uh—expediting desired results. Will you accept the assignment?"

I thought it over. If I had to take a

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winter vacation, I could just as well spend it at Cape Canaveral. Besides, as a Company stockholder, I was kind of pleased at being able to shove my oar into a Company investment.

If the job stretched out longer than I wanted, I could always get myself fired. I was also an expert in getting fired.

I said finally, "Okay. I'll give it a whirl. How do I get down there?"

Mickleberry handed me an airline envelope. "You can catch the next Orlando flight from LaGuardia. I will phone Dr. Jardeen about your flight time."

"Who's Dr. Jardeen?"

Mickleberry disregarded this. "Your flight leaves in one hour. Clear jets, captain!"

Whatever that meant. I took it as dismissal, grabbed my suitcase and was lucky enough to hail a cab at the building entrance.

On the flight to Orlando I reviewed what I knew about mining on the Moon. There had been a very handsome color spread of future operations in that quarterly report. The kilometer-wide space wheel in Moon orbit

the magnetized ore-carts docking at the wheel with their Moon-cargoes of bauxite, titanium, iron, silicates, crust-oxygen . . . the hub factories and the spoke farms terraced with Moon dirt. (Apparently hydroponics was Out and Moon dirt was In) . . . the bat-wing space shuttles on their Janus/Double-Thrust rockets . . .

I had never in my life heard of anything quite so screwy.

I deplaned at Orlando. Nobody was waiting for me in the airport terminal, and no message had been left at the airline desk.

One hell of an outfit, I reflected. They were planning to put The Big Rock Candy Mountain into orbit, but they could not lift a guy from Orlando to Canaveral/Kennedy.

While I debated about renting a car, a hand touched my sleeve and a friendly voice asked, "Are you Captain Schuster?"

I turned to look at a shipshape young chap—ruddy face, healthy eyes, curly brown hair foaming over his forehead. He wore a white cotton pullover and college-boy jeans. I said,

"Yeah, I'm Schuster. Did Dr. Jardeen send you?"

"No. I'm extemporizing. I'm a CRM, and your flight data transited my panel. When Dr. Jardeen event/cancelled, I knew he was stonewalling, so I put a rec on a car. This your suitcase?"

I nodded. He picked the suitcase up and led me to a car illegally stationed in the Arrivals lane. He slung the suitcase into the rear seat, I tossed my overcoat on top of it, and we dived into the car and pulled away fast before we got a cop astern.

I had not understood a single damned thing the young guy had said. As I eased the seat-belt straps around me, I began,

"You say you're a CRM. Got a name?"

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"Yes, but you won't want to clutter your brain-banks with it. In a project of this size, the function and not the identity is important. For example," he continued as we bowled along the wide, flat toll road, toward the oncoming night, "I'm a Communication Relay Master, working Time Phase 2. An event in my reference frame is coded CRM2."

In other words, I reflected, the kid was like a ship's radio officer. I went on hacking through the word jungle. "Who's Dr. Jardeen?"

I thought the kid would run off the road. "Why, Dr. Jardeen ideated/implemented the entire project! How can you be ignorant of his identity?"

"I figured it was the function that was important, not the identity."

This playback stopped him cold.

He activated the headlights. I said nothing more. I had already pegged CRM2 as a well-meaning young fellow. In the matter of my arrival he had acted with initiative and good sense. I was betting he would level with me faster if I did not push him too hard.

I had read him rightly. We drove for a while. Then he said, "Dr. Jardeen is a sensitive man—a genius—but I feared he was not considering the consequences of refusing Mickleberry's call. I told Mickleberry that Dr. Jardeen was in conference, and I took the message about your flight time. Ordinarily Dr. Jardeen would have met you with his private helicopter. The best I could do was to find a CRM to finish my shift while I scrounged a car from the pool and drove over here.

"Don't get me wrong, Captain Schuster. I'm not criticizing Dr. Jardeen. He's a terrific scientist. This project is like—well, Instant Utopia. A space colony planned for perfection—a place without disease or crime or poverty—"

He took a deep breath at the beauty of it all. He was young, of course. He would learn the hard way, like the rest of us. He went on,

"Perfection can't be built piecemeal in space. It's like a jigsaw puzzle put together on Earth, carefully separated and lifted into space, and reassembled in orbit.

"But after Bennington's takeover, this orderly process was disturbed. Bennington wants to hurry the Moon mining so the Company will make money. Dr. Jardeen hates commercialism."

"Oh? A guy who can meet guests with his private chopper ain't giving away his services."

Another silence. I was dog tired, fighting for a toehold on a bureaucratic ALC. The way I figured it, if Jardeen was dodging the Company, it was because he was deliberately responsible for the work-lag. If the foul-up had been inadvertent, beyond his control, he would have jumped at the chance to justify himself.

Probably Jardeen was, as the kid had said, a terrific scientist. Bennington would go slow about removing him, especially since other key men might quit in protest. I had to out-

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flank Jardeen—put a wedge between him and those key men—isolate him so that he could not block our countermeasures.

The only wedge I had so far was the young man sitting beside me. I began honing him down. I asked, "What's your name? I can't keep calling you CRM2."

"Herbert Douglas. Mostly, just Herbie."

"You gonna get the heave-ho for meeting me?"

"No. When Jardeen event/cancels, the CRM can make an assessment/decision. Refusing calls is a genius-reflex. Dr. Jardeen expects the CRM to utilize existent directives. There was no directive on Schuster, and Dr. Jardeen is opposed to sequential logic. He wants every event to be handled as a discrete space/time segment."

"Spell that out, will you, Herbie?"

"Sequential logic would have said, 'Since Dr. Jardeen does not want to talk to Company executives, he naturally will not want to have Captain Schuster at the ALC.' But discrete analysis assesses Company/executives/Schuster without connecting them in any way."

No wonder the project was not moving. Each unit was like a train of disconnected freight cars.

I gave the problem more thought. Despite the double-talk, Herbie had stepped way out of line in meeting me. In issues like power politics, Jardeen's logic probably was as sequential as the next guy's. Of course, maybe Herbie was the kind of secretary/assistant who can save an impulsive boss from embarrassment without being hauled over the coals later.

The closer Herbie was to Jardeen, the more leverage I would need to get him on my side. I remarked,

"You're really all fired up about putting this space colony in orbit, hey?"

He said quickly, "But I don't want a botch job because of the profit motive."

"Well, Herbie, when I say the Company wants a productive investment, I'm not talking about ripoffs. I'm talking about Moon ore being mined as quickly and efficiently as possible. The result will, we hope, improve the quality of Earth life, but it will not bring Instant Utopia."

I paused, then said seriously, "If you demand Utopia, this project will never be anything but a bankrupt boondoggle."

He kept his eyes on the road. I went on, "I was sent here because Jardeen is not delivering the goods. He is not mining Moon ore."

Herbie asked uncertainly, "Does that mean the ALC personnel have to choose up sides? The Company versus Dr. Jardeen?"

"You're utilizing sequential logic," I reminded him. "Let's take the action in discrete space/time segments. To begin with, all I want is a conference with the department heads—and with Jardeen, if he'll come. Can you arrange it?"

He thought it over. "As a CRM I can relay your request to the relevant

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function/persons. Should they bring data files?"

"If each guy wants to hand me a summary, I'll glance through it. But it's gotta be short."

He drove steadily through the headlight-sculptured darkness. I thought about the paperwork, and naturally I went to sleep. When I woke up, the car was stopped. I was slumped uncomfortably, the shoulder sling of the seat belt was digging into my collarbone, and my mouth was as dry as Moon dirt.

I straightened up. The car was parked in front of a motel office, and Herbie was gone. I unfastened the car belt and unfroze my stiff muscles.

Herbie came back, opened the car door and handed me a room key. He smiled, "We're just south of the Kennedy Center. I took the liberty of checking you into a room."

I uncrammed myself from the seat and accepted the motel key. I stood, kind of groggy, and watched Herbie drag my suitcase and coat out of the car. I remarked, "I must have been sawing wood pretty hard."

He grinned. "Well, if I ever go into orbit with you, captain, I hope your sleep-tank is soundproofed."

The Old Man in orbit? That would be the day. Thirty thousand feet was my ceiling.

Herbie went on, "I'll do my best to promote the conference. A car will pick you up at nine tomorrow morning."

I asked, "Can you be detached from your CRM panel? I need a guy like you to take soundings for me."

He said slowly, "I'm really a Jardeen man, Captain Schuster. I just about worship the guy."

"All the better. I don't want to fight with Jardeen. I want to help him get this show on the road."

Herbie smiled, "Since you put it that way, I can formulate a replacement request through PP. Dr. Jardeen does not demand any specific function/person on CRM2."

Jardeen was shaping up as a real educated idiot, I reflected. I took my suitcase and overcoat from Herbie, found my Earth-level sleep-tank and hit the hay. I felt that if I had to listen to any more space jazz, I would blow my stack.

Cape Canaveral is imposing, of course—a vast pancake crisscrossed with cement roads and dotted with launching sites. Space Mining Inc. had been allotted what looked like a handkerchief as Herbie drove us toward it the next morning. The nearer we came, the bigger it got, and we were ant-sized by the time we stepped into the multistaged assembly hangar.

On the ground stage was a plywood-and-glass room that apparently was used for jawboning. Battered folding chairs were set out on the cement deck. They faced a slightly-raised platform with a table and more chairs. Behind the table was a blackboard on an easel.

That I had achieved a conference right off the bat must have been due

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to Herbie's persuasions. He could not let his idol Jardeen get in trouble with the takeover management.

Herbie ushered me into the empty room and said, "Group coordination of assessment procedures may necessitate a temporal readjustment."

"Herbie, do me a favor and knock off the pig-Latin."

"But, captain, the sea also has a work-related language!"

"Work-related, yes. It gets space-cute only in small-boat marinas. I once heard the owner of a fifteen-foot motorboat yell to his wife to freshen her nip, and I didn't know which way to look. All the guy meant was that the boat's mooring line was chafing at the bow."

Herbie clutched his curly mane and stuttered out an unpracticed laugh. It looked as if humor was in short supply at Space Mining. From what Herbie had said about Dr. Jardeen, I wondered if I was getting into a cult-bureaucracy. If so, my first step would be to shake the cultists until their teeth rattled.

About a dozen guys in white boiler suits were trooping into the hangar, three of them bearing solid chunks of paperwork. Herbie pulled himself together and surveyed the gang through the glass. "The chiefs—but not Dr. Jardeen, yet."

As the chiefs filed into the conference room, the three leaders piled their data chunks on the table. Herbie introduced these three first, by function not name, "PPC—MBFC—TTAC—"

The rest of the crowd was more alphabet soup. They shook my hand and sat on the scattered chairs. I realized I would have to put the operation on a name basis as soon as I could. I suspected that part of the work-lag had come about because Jardeen had reduced his team to human hardware.

A small vehicle like a golf cart puttered into the hangar and stopped. The driver got out and came into the conference room.

Even in a white boiler suit, Jardeen had presence. Although he was not really stout, there was a softly benevolent plumpness to the skin on his face and hands. His cheeks were apple-red, and his eyes were the dreamy amber of a satisfied cat.

He favored his team with a gracious nod. He gave me a condescending smile and a space sermon. "Captain Schuster, previous data exchanges between the Company and ourselves have obviated the necessity for verbalization of our common goal of space penetration according to the principles of Human Rights. Across the relevant horizontal levels—"

I let him rave while I watched his team. If they all agreed that it was the Company versus Human Rights, I was up the creek. I had intended to hit the Space Mining line like Ohio State rolling over Indiana, but I saw I would have to pull my punches. Most of the team were, like Herbie, giving Jardeen all their respectful attention. Some were poker-faced, taking a wide-angle view.

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And one guy—TTAC—was watching me watching them.

Jardeen was droning on, "—further breakdown of the vertical structure. The data sheets have been supplied you."

I woke up and looked at the paperwork on the table. I remembered that TTAC had put his chunk on top of the others. I lifted it off and said, "Well, Dr. Jardeen, if I knew how to read and write, I'd be applying for a better job. What's this stuff? Anybody care to verbalize?"

As I had expected, TTAC spoke up. "That's the data for a torus."

I grinned. "Jeez, I didn't ask for my horoscope!"

Nobody cracked a smile. Jardeen's benevolence got a little tight. He said, "Torus Technology/Assembly! The space wheel! The colony satellite!"

"Yeah, but why do we have to build a satellite?" I interrupted. "What's wrong with the satellite that's already up there?"

They all stared at me. Jardeen said, "Captain, there is no satellite—!"

"Since when is the Moon not a satellite?"

"The Moon can't be colonized!" exclaimed Jardeen. "It should be held open for common use by all nations able to reach it! The Moon can't be adjusted to simulate Earth gravity, in the manner of a torus! The Moon has a darkness phase! It can't be sunlight-oriented! It can't—"

"It can't be shot down."

They stared at me again. I said, "You bleeding-heart Utopians can talk about Human Rights and Common Use—but over my dead body is the Company gonna invest my hard-earned dough in a billion-dollar clay pigeon!

"A space wheel a kilometer in diameter is a sitting duck," I went on. "A real setup as a military target. Vulnerable on all sides to meteors and space debris. Making no sense economically. The ore is on the Moon. The dirt for agriculture is on the Moon. Use them on the Moon."

TTAC spoke up. "It's not Utopian to wonder about the Russian reaction to a western usurpation of Moon territory."

"Nuts. The Russians would welcome an American colony as a precedent for their own Moon expansion—if the time ever comes when they can put a man on the Moon—and if he doesn't defect the minute he lands there. Forget the Reds. They can't do a damned thing except bang their shoes on the table and try to outbluff us."

This got a mixed reception. I figured I would rather deal with hawks and doves than function/robots.

Again, the TTAC recovered the ball. "Leaving politics aside, captain, gravity was a factor in the choice of the torus. Space workers should not be asked to live in uncomfortable, debilitating environments."

"Well, Mr.—? Can I have a name?"

"Holloway."

"Mr. Holloway, I admit that human muscles will need training to

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work on the Moon—just as they need training to work at sea—but they won't atrophy. The Moon-walks have already proved that it takes as much muscular skill to keep from falling up as to keep from falling down. The old idea that muscles would grow flabby in Moon gravity has gone by the board. They have to be used a different way, that's all."

"What about the Moon's dark phase?"

"Well, what about it?" I returned. "As I understand it, any space structure will have to be completely shielded against cosmic rays. Even on a wheel, nobody will be sunbathing."

An amused murmur loosened up the gang, but Herbie reddened at my dumb remark. Holloway explained, "I was referring to the storage of solar energy during the Moon's long night."

"Solar energy! It's all over the damned place! Is the Sun any brighter next to a torus than next to the Moon?"

"And where would you place the solar energy station?"

"The Company is not paying me to interpolate a Nautical Almanac and decide where to moor a Moon energy station. That's your department. How much station hardware have the subcontractors delivered?"

There was an uneasy pause. I saw I had hit upon a divisive issue. Jardeen seemed to go on the defensive. He said, "Delivery must mesh with insiloing. We cannot build a space colony one piece at a time."

I had always supposed everything—including Rome—had been built one piece at a time. I sensed my comments were not wanted, so I let the matter rest and skimmed the next section off the data pile. "What's this?"

The MBFC answered. "Medical/Biological Factors. Physical requirements for colony members—space hygiene—pathogenic precautions. I would advise strongly against cutting corners in MBF."

"Are you a medical man or an engineer, Mr.—?"

"Dr. Grant. Medical."

"Dr. Grant, from all I've ever read about the Moon trips—especially from the astronauts' own accounts—95% of NASA's physical and mental vivisections were unnecessary and had no bearing whatsoever on the work that was done."

"That's a narrow view, captain. The NASA tests provided a wealth of research material."

"Maybe so. But Space Mining has a narrow budget. We can't afford to subsidize medical research. MBF's job will be to make sure that employees are fit. A space worker must be sound in wind and limb. No heart trouble, ulcers or hernias.

"But—," I paused for emphasis and included the whole group, "—if you guys think it is possible—or advisable—to keep the common cold out of your Instant Utopia, you are absolutely dead wrong, criminally wrong."

They were staring at me again. I went on, "The best way to destroy a

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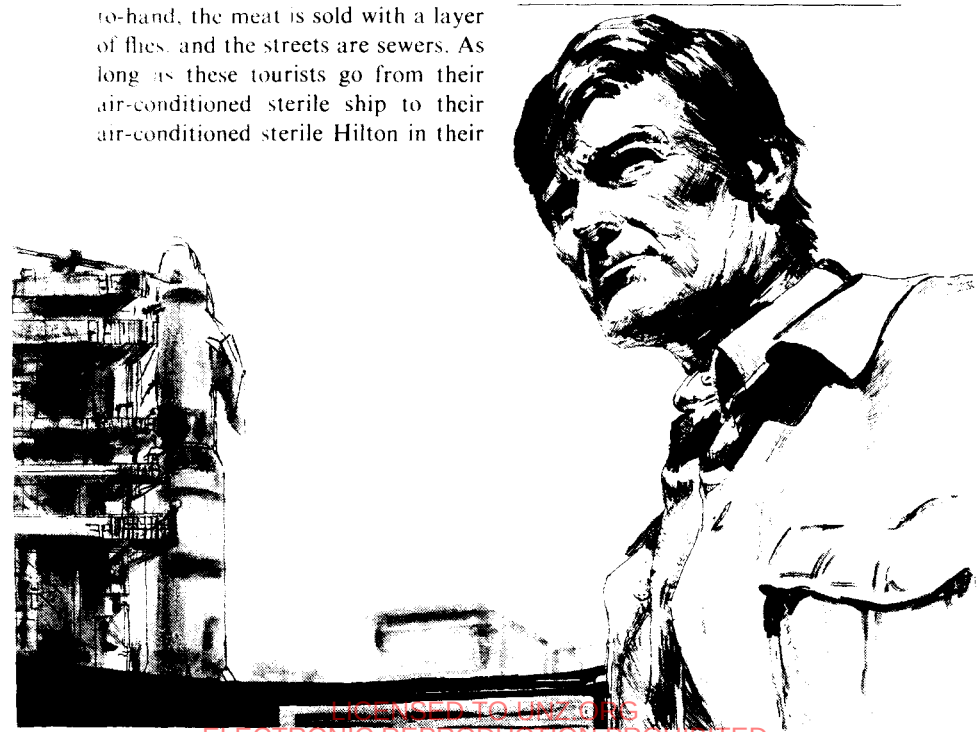
space colony is to make it germ-free, disease-free and sterile. A guy living in that sort of artificial atmosphere will die in a week if he returns to the Earth.

"I know what I'm talking about—I know damned more than the high-domed theorists—because I roam around the planet on a man-in-the-street basis. Seamen like me have every germ on the planet inside them, continually immunizing them. A very smart port doctor in Madras told me once: 'It takes a lot to kill a seaman.'

"But just one breath of nonsterile air will send an American tourist grabbing for his paregoric. American cruise tourists, coming from their hygienic plastic-wrapped, supermarket milieu go ashore in countries where oven-warm bread is delivered hand-to-hand, the meat is sold with a layer of flies, and the streets are sewers. As long as these tourists go from their air-conditioned sterile ship to their air-conditioned sterile Hilton in their air-conditioned sterile limousines, they're okay.

"But the first time they step onto the street, they come down with nausea, diarrhea, common virus infections—and blame the local water instead of recognizing that their own overprotected isolation is what has made them sick. Sterility is not natural to this planet."

Before Jardeen's team could fall on me like a ton of bricks, I added, "Now, I want to make two qualifications. First, I agree that Earthmen should not bring Earth diseases to other space life. The Polynesians were nearly wiped out by the smallpox brought to the Pacific by European whalers. That was a tragedy that must not be repeated in space.



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"But the Moon colony will have just ordinary germ-filled Earthmen. They'll catch colds and minor and major diseases—like the rest of us—and maintain the immunities built up since all of us apes came down from the trees.

"The second qualification I want to make is that I'm not—repeat not—saying that smallpox is good for us. I'm all for eradicating every disease as smallpox finally has been eradicated—*provided the eradication is species-wide in scope.* Then everybody is on the same immunity level. It would be a terrible mistake to make a space colony into an isolation chamber where a sneeze would kill the colonists like flies."

Dr. Grant asked, "Will the Company erase our psychiatric program?"

"I don't know the extent of your program. We have a staff psychologist who interviews guys who suddenly start putting their pants on backwards, but I can't see the need for in-depth headshrinking. I mean, let's face it—the world's pioneers are not generally well-adjusted, rational types. Neither Dan'l Boone nor Davy Crockett would have scored high with the NASA shrinks, and the West was explored by weirdos who were one step ahead of a sheriff and/or a butterfly net.

"In my book, anybody volunteering for the Moon has to be nuts from the word Go. If we start examining sanity, we won't have any work crews at all."

Herbie protested, "Oh, no, captain! Everybody working on the ALC has applied to ride the shuttles! All of us want to blast off for the Moon!"

I ducked my chin and eyed Herbie gravely. There was a burst of laughter. I grinned, "Yeah, I was overstating—to make a serious point. The psychiatric norms for suburbia are not necessarily relevant in space."

Herbie subsided, but he was not happy. I tackled the last chunk of data. "What's the rest of the bad news?"

The PPC said, "Personnel/Payroll. And my name is Lyle."

"Giving you guys the third degree, am I? Well, Mr. Lyle, why so many Personnel tabulations? Has there been a check on redundancies?"

Lyle said stolidly, "Given the traveling-unit system, our work force is barely minimal."

"What's a traveling-unit system?"

Jardeen resumed the floor, beaming. I could tell he had invented the traveling unit and thought it was the cherry on top. "It coordinates the rotation of the shuttle schedules. In succession, an assembly unit, service unit, countdown unit and space unit will work the Alpha shuttle. Upon finishing the Alpha, the assembly unit moves to the Beta, the other three units traveling to the Beta in due course, according to function. Meanwhile, since the Alpha will be returning while the Beta is blasting off, we have a third intermediary set of units to service and man the second Alpha trip. When the units go from the Beta to the—"

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"Hold it!" I ordered. "I seem to count twelve units niffnawing around two shuttles."

"Think of the units as a conveyor belt of discrete segments keeping the shuttles in constant operation."

I thought of it as progressive bankruptcy. I asked, "Why do we need separate units for each shuttle? Is there so much variation in technical competence?"

They looked at each other. Lyle said to me, "We don't understand your question, captain."

"One peculiarity of space research and construction is the high level of formal education demanded by all aspects of the work. I assume that the men in one unit are technically as competent as those of another. You can shift men from one unit to the next without difficulty."

Lyle considered. "An engineer tends to specialize to know more about certain systems than others, but yes generally the personnel can be interchanged."

"That being the case—and accepting the fact that all of you have applied to ride the shuttles—is there any reason we can't put together an all-round team that can assemble, service, lift-off and work in space? One slightly expanded unit instead of a conveyor belt?"

"Technically there's no barrier. But you would take great risk in eliminating the backup checks possible with the interlocking units."

"Well Mr Lyle, one reason why submarines have so few disasters is that the guy responsible for closing the topside hatch is inside the sub. When the skipper orders, 'Take her down,' he doesn't worry overmuch about the function/person forgetting his duty. If a shuttle worker knew that his name was likely to be pulled from the hat for the Moon lift-off, he would be double-checking to save his own skin and would not be so likely to goof off and let the next guy find the errors.

"But personnel is a kinky problem I have to go into later." I restacked the data files with a pleasant sense of relief and accomplishment. "I want to thank all of you for coming and clueing me in. You've been a big help."

TTAC Holloway doubled over with a haw-haw. Some guys smiled, but the rest looked pole-axed. Herbie's bewildered eyes were begging Jardeen to set the meeting to rights, but Jardeen apparently was not at his best with the in-fighting. All he could say was,

"Captain, I am amazed that the Company would send a spokesman who knew so little about this space project."

"Dr. Jardeen, the Company doesn't give a damn about your project. They sent me here to channel your resources into mining Moon ore—a limited, specific, economically feasible operation."

I faced the department chiefs and went on, "A financial takeover is tough, I admit, but are you and the Company really at cross-purposes? Would a compact, productive Moon colony be such a bad first step into

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space? Would it violate any basic Human Rights or anybody's Pursuit of Happiness?

"I don't say a torus will always be a lot of bull. To spin a future colony to Mars—fine and dandy. But not now."

Herbie had anti-Schuster feelings written all over his pan. I still wanted him as my liaison man with the departments. I said to Jardeen,

"Thanks very much for your cooperation—and for letting me commandeer a CRM who must be one of your most loyal and most valuable assistants."

"I'm a Judas," blurted Herbie, red as a beet, to Jardeen. "Schuster said all he wanted was a conference. He said he wanted to help you get the show on the road. Now he can find another CRM."

Even Jardeen's fan club smiled at Herbie's whole-hearted devotion to a lost cause. With more humanity and less jargon, the plump scientist said to Herbie,

"We all assessed the Company's takeover motives wrongly, and you are no more at fault than the rest of us. Had I accepted Mickleberry's call—or had you refused to aid Captain Schuster—the result would have been the same. This conference would have been inevitable."

Herbie brightened. Jardeen went on, "We must now work within Company framework to ensure that mercantile ethics do not override human ethics. No need for further disorientation, CRM2. You have established a familiarity basis for future assessment/decision and can ideate/implement more effectively than a replacement."

This rebuttal scored a point for the Utopians, but I figured I still had managed to get between Jardeen and his department heads. It was not only that I had reminded them of the Company's financial clout. I had proposed an alternate program to get the shuttles into space. Men can become so frustrated over a logjam that a stick of dynamite looks like salvation.

The meeting broke up with another round of handshaking. Herbie trailed me out to our car. I said matter-of-factly, "I gotta send a coded telegram. Where's the nearest Western Union office?"

Herbie struggled with his ideals and decided he could not make the grade. "Even for Dr. Jardeen's sake, I can't work with you, captain. You lied to me and used me. I think you're contemptible."

"You're not looking at the whole picture," I told him. "I warned you, you know, that you could not demand Utopia. Yes, you smoothed my path to Jardeen—but you smoothed Jardeen's path even more. If he had continued stonewalling, he would have been O-U-T. You were his best friend in the matter, not his Judas.

"Bear with me, Herbie," I went on. "When the first shuttle lifts off for Moon orbit, maybe you won't take such a negative view of the Old Man."

He was thoughtful. "What do you

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want to send in code? What's so important?"

"Bennington has to lease an unused NASA pad so that we can begin preshipping the nuts and bolts into Moon orbit. The energy station has to be positioned above a lunar pole before the shuttles go out there."

"But, Captain Schuster, you heard Dr. Jardeen say the station hardware had been in-siloed!"

"Then we'll just have to out-silo it. With a second launch pad and a transfer of a few niffnawing shuttle units."

"But how can you be sure that one all-round team can build and work the shuttles?"

"Because generalization—not specialization—has been the historical pattern for all successful pioneering. Do you know who the old Vikings really were, Herbie?" As he shook his head, I continued, "They were just a bunch of guys who lived around the same *vik*—another word for *fjord*. During the winters they all tramped into the forest, cut down trees, dragged the logs home, split them into boards and built longboats. In the spring they launched the boats and piled aboard, every manjack of them able to sail, row, repair, fight, and cook *lapskaus*."

"But, Captain, you can't compare half-savage boatbuilders and raiders with men trained in the subtleties of modern engineering!"

"Herbie, ask any naval architect to name the most brilliantly engineered vessel. He'll tell you it was the longboat. No hull before or since has combined such strength, elasticity, or speed through heavy seas. And it was built with dull iron, and stone whittlers. Assembling a space colony from premanufactured hardware is like falling off a log, compared to the skill demanded by that half-savage engineering.

"The all-round Viking teams erupted into a world of specialists—warriors, scribes, peasants—and they took that world like Grant took Richmond. Before the Black Death wiped them out, the Vikings ruled the seas from Greenland in the West to Constantinople in the East.

"When men go into space, they must go as an all-round, self-contained gang, or else they won't survive in a totally hostile environment. Although why they have to leave a pretty good planet for a lunar ash heap," I added, "I will never know."

"You are including yourself out of space travel?"

"That's a ten-four, kid. In a pinch I might consider flying Concorde. But the Janus/Double-Thrust booster? No way!"

Herbie laughed. As I had hoped, he was a good-natured guy and was willing to believe the best of everybody—even of that sly old bastard, Schuster.

For a week, Space Mining Inc. lay hove-to, with backed sails. I had made my report to Bennington, and I assumed Jardeen had done the same. Because I liked Herbie too much to

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pull another rug out from under him, I was glad I could hold off asking for Jardeen's removal. I had seen at the conference how I could bypass Jardeen and work with the department heads. Jardeen was a nitpicker in practical matters, but he was a prestige asset. Investors like a big name as a company director. I decided there was no urgent reason for getting rid of Jardeen.

It was a bad, almost fatal decision. Yet I made it according to the best evidence I had at the time.

During that week of waiting for Bennington's word, Jardeen kept aloof—a genius-reflex, maybe. I hustled around the ALC buildings like a grass-roots politician, selling the Moon colony.

I had to sell it. I could not build those shuttles myself. By the end of the week I had found out the technical changes necessary to the new program. The winged shuttles were strictly Earth orbit vehicles. We would need small jet-dollies to discharge the shuttle cargo and jockey it down to the Moon.

The torus components would have to be reworked into surface structures. The entire wheel was of interchangeable parts, so I foresaw no expensive alternations. The farm-area spokes could be laid down as they were, wherever a Moon sea could be bulldozed into a spoke contour. I was in favor of decentralizing all areas, to spread the risk in case of a meteor strike or other catastrophe.

Bennington issued the go-ahead for the Schuster Plan and leased the required NASA pad. I immediately called for a parts inventory to determine how soon we could shoot up the orbiting energy station.

The inventory computers replied NO PARTS AVAILABLE. The Space Mining warehouses were jammed to the rafters and insured for more than Fort Knox—and there were no parts available?

The time had come for me to find out if the department chiefs were for me or against me. I buttonholed TTAC Holloway and said, "We gotta talk. Someplace away from these damned phones."

He eyed me. "Will the Company pay for the drinks?"

"Yeah, Mickleberry is used to my representation tabs. Is your car here? Will you drive?"

"With pleasure."

We wound up in a Cocoa Beach bar. Holloway turned out to be a congenial rye-drinker, intrigued by the idea of a space wheel but not closed to other colonization methods. He explained about the nonavailable parts.

"Jardeen was computer-programming the shuttles to deliver optimum loads at specific time periods. Having stowed ships, you understand stowage problems—as when Port A's cargo is underneath Port B's, so you have to move Port C's in order to move B's in order to get at A's."

I laughed, and Holloway went on, "Jardeen intended that the wheel spokes, the hub, and the power satel-

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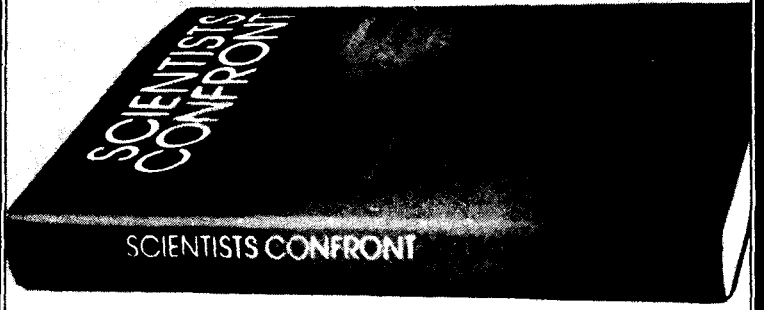

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lite would be assembled simultaneously. Thus, theoretically, it would be more efficient to have each shuttle cargo contain the spoke, hub, and power components needed simultaneously at that time/stage.

"Well, captain, the entire project ran to several million components, from microscopic transistors to steel girders. The computer obligingly gave a time/stage breakdown, but this implied that each of the several million components would be delivered according to plan. The subcontractors are not able to do so. It would be, I believe, humanly impossible. There we sat, while the silos filled and the components piled up—'inconsequentially', as Jardeen complained—and nothing got off the ground."

I remarked, "Jardeen could have finished the shuttle, at least."

"Not even that. Except for the control cockpits, which are factory-finished, the shuttles are being delivered in sections to be modified and fitted up as per our requirements. These modifications use some of the same components as similar fittings on the wheel. Once the computer had insiloed a component for a time/stage, it had to stay there. No borrowing from Peter to pay Paul.

"And then, of course, the discrete time/space segments make coordination difficult. In my own department, a TTAC3 could be one of the half-dozen assistants. Jardeen is fanatical about erasing identity from scientific processes."

"For what reason?"

Holloway took a swig of rye. "The wheel represented a kind of Nirvana. It would be a heaven of selflessness and harmony. People were biological cogs. The idea of stating 'John Doe worked this shift' is completely repugnant to Jardeen."

It seemed to be the old story—the guys who yell the most about Human Rights are exactly the ones who want to clamp down hardest on Human Freedom.

After I talked to Holloway, I set about unfreezing the time/stage insiloing. It broke Herbie's heart, seeing the computers disgorge the stray pieces for our nuts-and-bolts preshipments.

I had decided to put unmanned cargo canisters in a string-of-beads orbit around the Moon. A jet-dolly fore-and-aft would berth each canister on the Moon as neatly as a gull landing on the beach. The basic mine-camp structures, the transformer, the air and water recyclers, food and machines—the complete package would be waiting for the workers on the first shuttle.

My contribution to all programs was legwork—and finagling. If we had been forced to wait our turn with the space subcontractors for the canisters, jet-dollies, and other extra equipment, I would have had a long white beard before the first canister went into Moon orbit. So I cheated. I paid "rush bonuses" so that Space Mining hardware would get priority. I browbeat and swore and waved the Company flag.

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The bonuses eventually were leaked to the newspapers, and I got a bad press from holier-than-thou columnists who thought nothing of bribing a headwaiter. By that time we had got what we needed, and no harm was done. A lot of dough would be riding on that Alpha shuttle, and I could not afford any Alphonse/Gaston dithering.

One day I woke up to the fact that the month was now June. Six months had whizzed by without me noticing. I was in the hangar cubbyhole I used as an office. On my desk were the work-progress sheets. They looked good—I was proud of them—but suddenly I was so fed up with space hardware and space jargon, so homesick for a deck under my feet, that I phoned Mickleberry.

"We're pretty well organized now," I told him. "The solar cells are in lunacentric orbit, the cargo canisters are shooting up on schedule, the Alpha shuttle goes onto her Janus rocket tomorrow, the Beta shuttle is on Standby in the upper loft, the astronauts are in simulator training—and I want to get back to the ships."

"Have you any more surprises for our Public Relations department? We would rather be prepared for your—uh—flamboyant departures from rectitude," said Mickleberry.

"Those yapping columnists can't pin a thing on us," I assured him.

"Whom would you place in your job? Jardeen?"

"Hell, no. Jardeen is a visionary. Nirvana Or Bust. Keep him as a figurehead for investors, but give my job to Holloway."

"We have no opening in the fleet at present, Captain Schuster. We assumed you would be aboard the Alpha shuttle on her maiden voyage."

"If that's your joke of the year, Mickleberry, it isn't very funny. I'm like a fish out of water on this damned ALC."

"To the contrary, you have done such an excellent—if unorthodox—job that we are considering a permanent position for you with Space Mining. We'll keep in touch."

"Hey, you can't do that to me!" I bellowed into a dead phone. I hung up, reflecting that I would have to quit or be fired.

As if Mickleberry had not already ruined my day, Jardeen came into my cubbyhole. The last time Jardeen had wanted to see me, it was because I had written "The data *is,*" instead of "The data *are.*"

He now had something more important on his mind. He pinched his plump earlobe and began, "I note from the bulletin board that your Alpha soap-box derby team is drawing lots tomorrow for the initial lift-off. I'd like very much to be aboard, Schuster."

I was surprised, of course. I said, "Well, Dr. Jardeen, I was kind of hoping you'd wait till the colony was a going concern. We've been planning an official ceremony with ribbon-cutting and so forth."

"My dear captain! If I thought your

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jury-built, jerry-rigged one-piece-at-a-time Moon ghetto would actually materialize—"

"Jury-*rigged,*" I muttered. Him and his damned data-*are.*

"—I would not be requesting this ride on the Alpha. But your method has no possibility of success, and the initial Alpha is the only chance I will have to go into space for a very long time."

"I have nothing against you going into space," I said honestly, "but the Alpha has been stowed and fitted out for a Moon crew of eight cargo handlers. We can't discharge the canisters properly with fewer—in the same manner as a ship can't discharge cargo in normal time with fewer than a full longshoreman gang.

"Take my word for it, Dr. Jardeen, the initial Alpha trip will be a success, and the Beta will be right along after her. We can't restow the Alpha for an extra passenger at this late date."

He took my refusal with strained courtesy and left.

I had not realized that the Alpha draw was on the cards already. I legged it out to where the Janus booster was positioned. A notice board had been posted next to the conference room. One of the sheets read:

ALPHA CREW

Pilot . . . Astronaut Col. G. Fairweather

Co-pilot . . . Astronaut Col. F. Compton

8 Orbit/Moon crew to be chosen by lot,

Wednesday, 1300 hours

I felt tired but pleased. The Moon colony would soon be off the drawing board.

At 1300 hours the next day, all hands knocked off work and swarmed into the hangar. The Alpha gang had crammed themselves into the conference room. Herbie Douglas had scrounged a lottery cage from someplace and put it on the raised table.

As I ambled into the crowd outside the conference room, I became aware of grins and nudges. TTAC Holloway called me over to the notice board. The Alpha sheet now had "Schuster" scrawled in big letters, under "Compton," and the crew number had been reduced to seven.

For once my loud mouth had nothing to say. The guys haw-hawed and applauded. Holloway shook my hand and said, "You put us in orbit, captain! Go up to the Moon and sock it to 'em!"

I looked at the monster Janus,

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looming ten stories, a massive obelisk rising past the loft stages. I got all choked up. I said, "Gee, thanks, everybody. It's really swell of you, including me with the Alpha gang. I'll never forget this moment as long as I live."

I wished I had not added that last part, but the guys cheered and then crowded to see who would be on the first Alpha flight. I was too sandbagged to follow the proceedings closely. As soon as the drawing was over, I hustled to the MBF offices in the Administration Building.

I mean, Doc Grant would never let an old guy like me go into orbit!

MBF had my Company medical records in their files, of course. Grant gave me a brisk once-over, as if I was taking out insurance, and said,

"You're in excellent physical condition, captain—as tough as shoe leather. Blood pressure a little high—"

"On occasion it gets very high," I muttered.

"—but there's no reason you can't go into space. Momentary discomfort from the lift-off G's, of course, but otherwise all systems are Go. Mind you, under NASA rules you wouldn't be allowed up in a Piper Cub, but the Company's more liberal outlook enables us to take a common-sense approach. *Bon voyage*, captain!"

Hoist by my own petard, I reflected that there was nothing for me to do but get measured for a suit and join the briefing classes being conducted by Astronauts Fairweather and Compton.

When I got back to my cubbyhole I found Herbie waiting for me like a lowering storm. He burst out, "This is the dirtiest trick you've pulled yet! Telling Dr. Jardeen the Alpha was only for the work crew—and then weaseling your way aboard yourself!"

"Will you pipe down and listen, Herbie? It was the guys themselves who put my name on that sheet. What was I gonna do? Chicken out? There's still a full work crew, with me aboard. I can handle cargo, and I know what's

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in every hold of those canisters. I objected to Dr. Jardeen because he's not accustomed to wrestling cargo."

"Who can believe anything you say?" continued Herbie. "The newspapers are right—you'd sell your soul for the Company buck. You don't consider who you hurt! I don't care if the hangar gangs put your name on the list! A lot of Jardeen's friends think you cut his throat!"

I calmed Herbie down and sent him away. I had to take action before this lift-off hassle split Space Mining in two. I sent out a call for Astronaut Fairweather, and he arrived a half-hour later.

"I got a stinking mess here," I told him. "The Alpha load has been figured to the last kilogram, but if I don't let Jardeen aboard I'll have a Utopian mutiny.

"It's not only Jardeen," I added. "It's the fact that he's a VIP and expects service. We can't shove him into a corner and tell him to read a book while we work."

"Oh, I doubt that Dr. Jardeen expects service in a space shuttle," smiled Fairweather. "He may on occasion need help in suiting up—or grasping food utensils in weightlessness. Why don't you bump two guys and take Jardeen and Herbie Douglas? Herbie would be tickled pink to look after Jardeen."

Before I could protest, he went on quickly, "The shuttle will take care of herself when she's locked in orbit. Compton and I can join you guys on the jet-dollies. Frankly, we'd rather set the canisters down for you. Those dollies have been canned-up in outer space for weeks. If the retrofire jet controls are frozen, the dollies will have to be manually operated, and none of you have worked against Moon gravity. Jardeen and Herbie can stay aboard the Alpha."

"Can Jardeen handle a shuttle emergency?"

He grinned. "Well, it would be like asking DeForest to repair a TV, but he could do it. I don't know what emergency might arise. Holing by a meteor? Not a chance in a million."

As long as the astronauts were willing to help us on the dollies, I gave the okay for Jardeen and Herbie to come aboard. This necessitated a sad little ceremony as we drew two names from the chosen Alpha 7. The two losers were good sports about it. Their names went on the board for the second Alpha lift-off.

When the bat-winged long-hulled Alpha was finally poised on the Janus rocket, like a wide blunt arrow, I began to feel different about the trip. The feeling took me way back to when I was a small kid watching ships disappear over the horizon. Eventually I had run away to sea.

Standing on the top staging loft and watching the Alpha, I realized I had not needed to be pushed into space. Eventually I would have wangled my way aboard.

The day came when everything suddenly was for real. I was an awkwardly-encased space traveler riding that elevator to the shuttle hatch—finding

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my padded tier, strapping myself down [illegible].

We had lift-off.

A steamroller pushed me into a hole and sat on me. I guess I blacked out. I woke up fighting for breath, but the weight was gone.

I had a nosebleed I could not reach because of the helmet. I just lay there, taking an equal strain on all parts, while the other guys unstrapped, unhelmeted, and drifted around in weightlessness.

Herbie was attending to Jardeen, so Co-pilot Compton assisted me up, took off my helmet and thrust a towel in my face before my nose started drifting with everything else. Meanwhile, Fairweather was checking with ground control on our Moon course.

The shuttle jets boosted us out of our Earth orbit. Next port, Moon.

The extra payload made possible by the Janus meant that we were aboard a roomy, well-fitted-out craft. The cargo hold had no bulkheads, but the passenger quarters had two cabins in addition to the control cockpit and the airlock.

"Stand by for magnetizing," came Fairweather's order.

We could not stand anywhere, but we floated while the cabin made a half-turn around us. Fairweather had trimmed the craft from rocket-vertical to airplane-horizontal. The lift-off tiers folded against the bulkheads, our boots clung to the magnetized deck, and we had dimensions. Earth was astern, the Moon was ahead, and the cabin had up, down, and sideways, like the interior of a cargo plane. As the sun-side of the hull warmed, the filter-shield ejected on spidery struts.

I grinned to Jardeen, "You build a classy chassis."

"A fragment of perfection, captain. If only you had utilized your ruthless drive on the Wheel—!"

I did not want to rehash that argument, and fortunately I did not have to. Some genius had brought along magnetized card decks and poker chips in his flight bag. MBF had checked the bags for liquor, cigarettes and dope—just for the record—but had not censored the personal junk the guys had brought along.

We were in good spirits, without a care in the Cosmos. We were only a commercial construction crew, so we had no medical/scientific experiments cluttering up the cabins. Nobody was monitoring our hearts or lungs or physical processes, or telling us not to bet on filling inside straights.

Jardeen was a wet blanket, of course. The rest of us, including Herbie, suited up and popped out the airlock into space. The Earth was a mottled blue agate, as everybody had said she was, but after the first awe-filled moment was over, we horsed around in the great void and rehearsed our canister/dolly routines.

Jardeen went into space by himself, in a solemn, mystic way. He made Herbie feel like a roistering sinner and squelched the kid completely. Well, not completely. The first time I strapped down in my aft-cabin sleep-tier for a snooze, Herbie unstrapped from

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his own tier while I was sawing wood and jammed my helmet over my face. The helmet drifted off, of course, but it woke me with a scare.

I started to cuss Herbie out, but I saw by the shy grin he gave me that he was just using a leg-pull to tell me he was not mad at me any more.

Hour by hour the Moon's bright pockmarks approached and expanded. On the third Earth-day of our trip the Moon looked near enough to touch, and Fairweather and Compton were calculating orbital mechanics with Earth's ground controllers.

A navigator myself, I appreciated the skill with which Fairweather maneuvered above the proposed colony site, jet-spewed the lurid dye markers directly on target, and then chased up to the orbiting canisters. Now the exciting moment had come. We were allowing one orbit for dollying down one canister. A lost orbit meant loss of valuable time.

Leaving Jardeen and Herbie in the shuttle, Fairweather and Compton suited up and came out to show us how it should be done. It went like clockwork. The opening of the aft canister, the unloading of the two dollies, the positioning of a dolly fore and aft, the mooring of the rest of us along the canister-cleats, the suspense until the dye-marked site appeared, just short of the night-line, Fairweather's countdown, the dolly flares—and we were dropping like a leaf. A short retroblast that billowed the dirt under the canister—and we were on the Moon.

Weaving back and forth in the weak gravity like half-rooted seaweed, we unloaded the canister's cargo compartment and tested the seals of the residence cabin. We needed a work-break before we brought down the microwave transformer we had carried, along with space tools for space-suited hands, in the shuttle's cargo hold.

The next time the shuttle swung overhead, the eight of us piled like circus clowns on the two dollies and returned to orbit. We moored the dollies to hull cleats on the shuttle and entered the airlock one by one.

I was the last man in. As I unhelmeted I found a discussion circulating with the food packets. Herbie was saying,

"There must be something Dr. Jardeen and I could do!"

I answered at once, "Sit here and jaw with the ALC. You're passengers."

Jardeen objected, "But, captain, none of the work crew has been in space before! We all are on the same function level. We all have a right to participate."

"That's the trouble with you guys who work only with your brains," I declared. "You have no understanding of the timing of physical labor. You know the world only two-dimensionally, through your imagination. That's why all your Utopias end up on the rocks.

"The Alpha gang and I have actually worked with this hardware—picked it up, moved it around, fitted it

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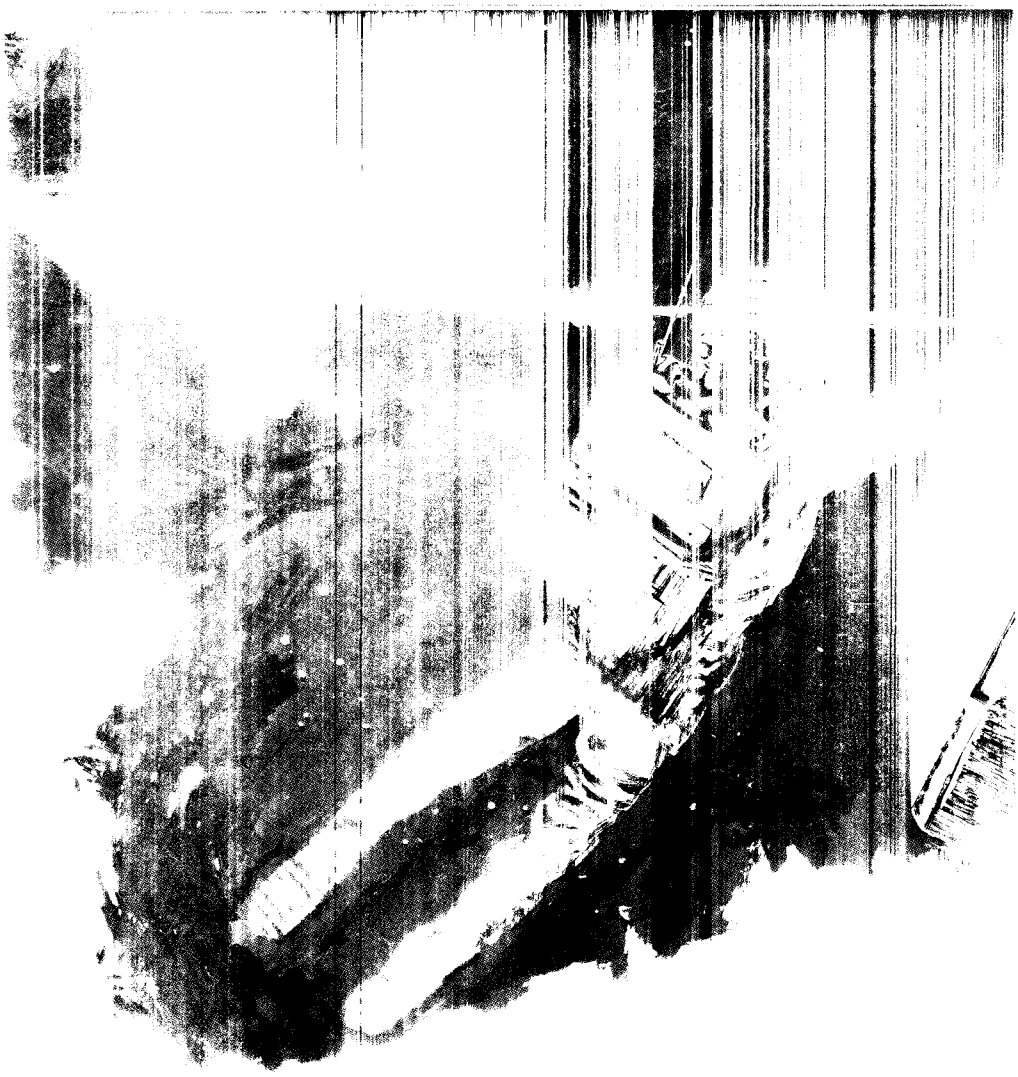

ll ·chelmeted, since two guys had to
e detailed to convoy Herbie and
irdeen, and the rest of us were
eeded to unload the transformer. We
ied out of the shuttle in good order,
racked the cargo hatch and began to
nsecure the transformer.

A crate of space tools was in the
way. Herbie was nearest. He unlashed
the crate and tried to push it aside. Of

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course, the damned thing took off and looked like it was going to plow us all down. Herbie dove after it to grab something—anything—

He caught the safety bar of a laser-beam cutter. The beam needled a zigzag path through the microwave transformer and sliced through the shuttle hull.

Just a split-second of carelessness.

The escaping jet of air from the shuttle cabin blew us and the cargo around like leaves inside an empty oil drum. I hooked a boot on a hatch brace and grabbed Compton, who managed to hook Jardeen. Three crewmen were safely anchored at the other side of the hatch, but four guys and the hardware were blasted into space. Each suit had an emergency jet-pistol for maneuvering in space, and I hoped everybody knew how to use it.

When Compton had a handhold on the brace, I let go of him and climbed over the shuttle hull to the moored dollies. A crewman from the other side of the hatch had the same idea. We activated the dollies and headed for the sparks that told us the missing crewmen were trying to jet to the shuttle. We picked up Fairweather and two crewmen in a hurry, but Herbie had disappeared.

I knew he was alive and in the vicinity because I could hear a hopeless whimper on my suit radio. Nobody else was saying a word. They were waiting for orders, and I realized that as project boss I had to make the big decisions. I said,

"Herbie! Use your flash gun!"

Weakly, "Let me die. It's all my fault!"

"Dammitall!" I roared. "You come back here and help us collect the hardware you blew all over the Sirius sector! We need every man on the job!"

The whimper sniffled out. I heard a murmur of "There!" as several guys spotted Herbie's jet-flash. I dollied over to him, nearly ramming the ruined transformer, which I swooped up on my way.

Herbie was still holding the edge of the tool crate with one hand, in his shock and utter misery. I dragged my assorted finds back to the shuttle and said,

"Okay, so we've holed the shuttle and have to repair the transformer. And we're marooned. But nobody's hurt, so we can continue with what we came to do—establish a colony. If we had been working with a single insiloed time/stage, we'd be in trouble because we would have no alternatives. However, the cargo canisters have been stowed for general use and are as specialized as a hall closet.

"Now, we're gonna divide into two groups. Colonel Compton, you take charge of the work crew and continue the canister work while stockpiling oxygen cylinders from all the canisters. Colonel Fairweather, with Dr. Jardeen, Herbie, and I will reenter the shuttle. If her rockets are still operable—and loss of air should have no effect on them—we will pick up the solar energy station and bring it here

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so that it can be dollied to the surface."

I heard the surprise and the muttered comment. I said, "It will be nearly two weeks before the colony site will be in shadow. We can use the solar cells directly for power and can start the recyclers almost at once. If we succeed in repairing the transformer, we'll put the station back where we found it."

Dr. Jardeen's voice: "The solar cells cannot be used directly without readaptation of Moon residence circuitry."

"Fine. It'll give the guys something to do until we get back."

An easy laugh brought things to normal. I said, "The Fairweather gang will switch to radio channel B. The Comptons keep A. Over and out."

The shuttle cabin looked as if a Texas tornado had hit it, but the reserve oxygen tank still had a full supply for our suits. We had lost Earth contact, but I saw no sense to wasting time on that circuitry. The cutoff was Mayday enough, and we could not hold our breaths until ALC answered it. We had power and propulsion. Fairweather and I took a celestial fix, and then we gave a short spurt to where we expected to find the solar station.

The multiple-section honeycomb was clearly visible against outer space. I suppose we could have detached a section, in the same manner as remote control had put them together in orbit, but I figured the dollies could handle the whole station in Moon gravity. As we slowed into the satellite's higher orbit, I stood on the shuttle's hull, wound up like a fast-ball pitcher and threw a nylon-line monkey-fist into the satellite's work-base struts. The line caught, I hauled her home, and—like a tugboat towing the QE2—we spurted back to canister orbit, where Compton and his gang—with two more dollies from the second canister—were waiting for us.

Within six hours the Moon-moored solar station was giving direct power to the Moon residence. When the lights went on and the recyclers started up, the residence was as comfortable as a well-built house-trailer. We showered in the needle-mist stall and hit the sack for eight hours of recuperation.

When we woke up, we unfroze some lobster thermidor and had a policy council. First on the agenda was patching the shuttle hull. The patch would not resist reentry burn—we would be as marooned as ever—but it would allow us to restart the shuttle's air recycler. If necessary, we could survive in the shuttle after the shadow-line had fallen across the Moon's solar cell station.

Naturally, we hoped the Beta would come after us within that deadline. Jardeen doubted that the ALC would respond immediately to the communication cutoff.

"If you recall," he explained, "the last time we talked to ground control, we were nowise in a hazardous situa-

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tion—merely about to unload the cargo hold. Since Captain Schuster has tried every trick in the book—and invented new ones—to hasten the Moon colonization, ALC may assume he deliberately sabotaged communications to force the Beta into space sooner than planned. You recall also, both astronauts were away from the cockpit—ALC certainly will note that fact."

Herbie was gray with guilt and despair. Jardeen glanced at him and added, "Of course, fire departments answer even false alarms—"

The tone rang hollow. We all knew the newspapers would be yelling, "Another Schuster gimmick!" Public opinion might keep the Beta on the ground until its scheduled lift-off the following month.

We put the Beta from our minds and made the best of being marooned. Jardeen was working over the mangled transformer. The guys decided they needed more room. They locked the air-seal door to the galley, reduced the galley to vacuum, cut away the aft bulkhead (fusing tight the seam in the insulation-packed double hull) and welded the second cargo canister to the breach.

All the canisters were double-hulled to protect food cargoes from cosmic-ray contamination. In the event of a meteor strike, the viscous insulation flowed to the pressure-escape point and gummed it up. By adding the second canister, the guys had a messroom and gym.

By the fourth day we were living in style, and the guys began wondering how they could get a few dames up there. I glared at them and barked, "If the dames come, Schuster goes!"

They chorused, "Bye, Schuster! Nice to have known you!"

My one worry was Herbie. He was in a suicidal mood from guilt and continuing shock. I kept him going by dinning into him the truth that we needed work from every man. His suicide would harm us and would not change what had happened.

After a pep talk Herbie would perk up for a few hours, but fatigue would make him sag again and begin whimpering, "But I might have killed somebody! I might have killed all of you! What if the laser beam had swept the other way! What if—!"

"A miss is as good as a mile," I would say. I wondered how I could get him back to Earth alive. He had to be suited-up to jet-dolly to a shuttle, and if he got a suicidal impulse on the way, nobody could stop him from wrecking his suit.

On the fifth Earth day of our marooning, we stopped talking about the Beta. This was the day the Beta would come, if the ALC had begun the two-day fueling of the Janus as soon as they had lost contact with us. We dared not hope for action that fast, implying as it did the elimination of careful backup checking.

That night after supper, a few of us began a poker game. The body-beautiful nuts retired to the gym to do pushups. Jardeen kept Herbie busy with plans to enclose the work area

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with a ray-repelling magnetic field. Jardeen may have been a science-idiot, but I could not fault his treatment of Herbie.

The airlock buzzer sounded, and the hatchway light began blinking. We just sat. The blinking stopped, the hatchway opened, and a clean new white spacesuit entered the residence. The suit's occupant unlocked his helmet, removed it and gave us a smile.

TTAC Holloway!

He gave me a nod. "Dr. Livingstone Seagull, I assume."

"What kept ya?" I deadpanned.

"You think you're kidding, but Mickleberry was bucking everybody from the New York Times to The League of Women Voters when he ordered immediate fueling of the Beta without the usual countdown checking."

"But the Beta gang was willing to lift off?"

"Sure. They built that shuttle with their own hands. They knew she would fly. We have spare hull plates in our cargo hold," he added. "Mickleberry figured you had run into a meteor shower, and he wanted us to salvage the Alpha even though—as he expressed it—her personnel had perhaps succumbed."

Old profit-and-loss Mickleberry. Holloway went on, "We saw your Moon spread before we went into orbit, so the slashed Alpha did not worry us. What happened, anyhow?"

Herbie wailed, "It was my fault! I did it!"

I explained, "Apparently in stowage the On-switch of the laser cutter was flicked back. When Herbie accidentally pulled the safety bar, we had a laser squirt until the bar snapped in place again. Just one of those things."

To change the subject I continued, "If you care to step up to orbit and invite your minions to inspect our country club, we'll tidy up a bit and bake a cake."

That night was more fun than a picnic. The way the Alpha gang, as Moon natives, lorded it over the Beta visitors was a sketch. The next day we got to work again. The repair of the Alpha coincided with Jardeen's completion of the rebuilt transformer, so we used the Alpha to put the solar satellite back where we had found it.

When the time came for the Alpha gang to blast Earthward, I think they were almost sorry to leave. Holloway was going with them, and I was staying with the Betas to mastermind the ore surveys.

Herbie's face got tighter and tighter as departure time approached. I could see he intended to kill himself as soon as he was out of the residence. I said to Jardeen, "We gotta shoot some emergency morphine into the kid. You can keep him sedated on the Alpha."

"My dear captain, are you mad?" fussed Jardeen. "Three days under morphine sedation could give the lad an addiction! Why, I wouldn't think of it!"

I could see only one way out. I did not like it, but I knew I would never

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forgive myself if I backed off and let Herbie die.

He had been slow about getting his suit, like a guy who looks at a pistol for hours before he blows his head off with it. I said to him, "Hurry it up, will ya?"

He was too depressed to hurry, and he was bewildered at the sudden harshness of my voice. I strode over to him and grabbed the front of his sweat shirt, as if I intended to shake him. In the weak Moon gravity it was easy to pretend I had shaken too hard, and I sent him crashing into the bulkhead. Blocking him out from the others, I leaned over, quickly grabbed his forearms and twisted them inward with a sharp jerk. I could feel the elbows dislocate and then jar into place.

As I lifted and supported the unconscious kid, Jardeen exclaimed, "What is the meaning of that uncalled-for brutality? Never in my life—!"

I ignored him and said to Holloway, "Help me get Herbie suited up and into orbit. With two sprained elbows, he won't be able to kill himself—at least, not by scuttling his suit or sneaking into the Alpha's airlock. We'll get him down."

Herbie came to, while we were stuffing him into his suit. His elbows were already swollen and discoloring, and I saw that I had bumped his head harder than I had intended. He gave me that bewildered look again. I told him,

"Sorry, Herbie. I had to keep you alive. Someday you'll thank me for it."

He was still giggling helplessly when we locked his helmet in place.

After the Alpha gang went home, we had four days of peaceful and productive work, although the residence was now in the darkness phase. We could have lighted ten football fields with the solar power from the satellite—and no bills from Con Edison.

The next day the guy who had the Communications watch handed me a curt message. Mickleberry wanted me, and the Alpha was blasting off immediately to bring me home.

I reflected that Mickleberry must want me awful bad, to send the Alpha back as soon as she had arrived.

Three days later I was on my way Earthward, with two newly-hired astronauts I did not know. All they could tell me was that Jardeen was giving me a bad press over Herbie Douglas. It did not seem like sufficient reason to send the Alpha. I would have expected Mickleberry to fire me and tell me to walk home.

On orders from the ALC, the Alpha held an orbiting pattern until Earth time at Cape Canaveral was 0100. Then we skipped into the atmosphere, the aero-jets roared to life, and we landed at the Canaveral air base as casually as a New York-Miami commuter jet.

I sure was happy when the Alpha's wheels hit *terra firma*. We cracked the hatch, and I took a deep breath of warm, soggy, wonderful Florida air.

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As I walked down the ladder, a limousine came racing across the runways and screeched to a halt in front of me. The security guard beside the driver jumped out and said, "Captain Schuster!" and opened the rear door.

I squeezed into the seat and dimly perceived a familiar figure. A precise voice said, "Good morning, Captain Schuster."

"Mickleberry!" I returned weakly, as the guard slammed the door and got back into the car, and we accelerated away from the shuttle. I went on, "Who unchained you from your desk?"

"I came down here this evening in the Company jet and will be in Operations at my usual time, after our conference."

Before I forgot it in the rush of other business, like getting fired, I said, "Thanks for the quick Beta liftoff. The guys wondered if you would think the communication cutoff was just a Schuster trick, what with the media—"

"We judge you by your actions, not by the media's words. Never once have you sent us a distorted report. That a licensed master mariner would fabricate an emergency—for any reason whatsoever—was beyond belief. I ordered the Beta fueling at once."

"And speaking of the media—" He handed me a newspaper and pencil flash.

I played the flashlight over thick black letters: JARDEEN CALLS SCHUSTER BRUTE. The article started out, "Company executives are remaining silent in face of demands for the repatriation and arrest of Captain Robert Schuster for his allegedly brutal treatment of Alpha crewman Herbert Douglas. 'Captain Schuster's deliberate maiming of this man is in direct violation of all Human Rights,' stated Dr. Claud Jardeen, . . ."

"Sonofabitch," I muttered.

"Yes," agreed Mickleberry. "Young Douglas has admitted, both to NASA investigators and Mr. Bennington, that he would have killed himself if you had not lamed his arms. He is recovering very nicely in the ALC clinic.

"However, the incident, on top of the previous publicity, forces us to remove you temporarily from Space Mining and employ you in a fleet matter which has coincidentally arisen."

"That so?" I murmured. A great, happy wave washed over me—a blue, salt-fizzy breaker I could feel, smell, taste—

". . . outward-bound from Cadiz," Mickleberry was saying, "rammed and sank a Liberian tankship. The Spanish authorities have impounded our ship and put our captain in jail. Damages and oil clean-up are mounting toward the half-billion mark. Our captain insists the Liberian was at fault, and we expect you to prove him right."

"Half-billion, hey? So that's what was worth shooting up a Janus. Otherwise you would have told me to walk home."

"We would have let you hitchhike.

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But, captain, the next time you wish to be relieved of an assignment, kindly do not resort to mayhem."

"Mayhem! For Gods' sake, Mickleberry, you don't think I'd rough up a kid—!"

I could feel his austere glare. "Need we review the previous ploys by which you have made yourself eligible for severance pay and unemployment insurance?"

I had to admit my record in that department was not so hot. Besides, maybe an in-depth headshrinker would say that I had gone off the rails with Herbie because of subconscious frustration at being kept away from my natural element, the sea.

The limousine stopped at the ALC clinic. Mickleberry handed me an envelope. "Your airline ticket. The Spanish flight leaves Miami this afternoon. We arranged for your belongings to be moved here from the motel. A clinic room has been prepared for you. Safe voyage, captain."

I climbed out of the car—definitely feeling Earth gravity—and slogged up the clinic steps. The night orderly let me in and showed me to a staff room. My suitcase and overcoat were beside the bed.

Before I hit the sack, I opened the airline envelope to look at the ticket. A second envelope was beside it, holding a nice bonus check signed by Bennington himself. I was glad to get it, but I figured I had earned it as the founder of the Moon colony.

The next morning I went to find Herbie Douglas. He was sitting in a sunroom chair, in bathrobe and slippers, his arms still in casts. His depression seemed gone, and he smiled at me. I said,

"Can you forgive me, Herbie?"

"Oh, I forgave you on my way up to the shuttle. I guess I really didn't want to die, but I would somehow have felt honor-bound to rip away my air-pack—if my arms had not been too lame and painful to move. I'm sorry Dr. Jardeen is making trouble."

"No trouble," I smiled.

"And I'm sorry, too, I didn't understand what you were trying to tell me about programmed Utopias," he went on. "The Moon colony turned out better than we had planned, exactly because it was improvised and open to new ideas. When you have a rigid, programmed mold, like the Wheel, you can't expand it or improve it. When you build one piece at a time, the construction is open-ended, with no limit. You can build and build—all the way to the stars.

"Dr. Jardeen was always talking about the perfection of Nirvana, or the perfection of heaven. But you can't improvise in heaven. Heaven doesn't seem so desirable to me any more."

I agreed emphatically. According to a usually reliable source, the main deal about heaven is that it has *no more sea.* I, for one, am not gonna sign up for a place with no sea.

Not that Anybody is gonna offer me a job there, I reflected as I left to connect with my Miami flight to Spain—and the ships. ■

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The realization
that there are
undiscovered elements
in pitchblend
totally changed the course
of twentieth century history
Will the realization
that there are superheavy
elements—much beyond
uranium—
equally effect the
twenty-first century?

The Island of Stability
by Margaret L. Silbar

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In the bicentennial summer of 1976, a group of American physicists announced their discovery that superheavy chemical elements have existed in nature ever since the earth was formed. Three or four different species, they claimed, are present in small monazite crystals in a mineral from Madagascar. If true, this is an astounding discovery, but maybe we shouldn't rejoice quite yet. Recently, two groups of European physicists have said "it ain't necessarily so."

It is nonetheless an interesting story, which began back in the thirties and which has recently led to a flurry of experiments and some new ideas. Here we will talk about what a superheavy element is and why it might have been expected to have been found. There are good theoretical arguments why there might be an "island of stability" far away from the shores of everyday nuclei. The question of whether nature or man can make these strange, heavy elements is intriguing—and unanswered.

Since World War II, scientists have made fourteen chemical elements heavier than uranium, the heaviest element that occurs in nature with any abundance. The periodic table's present boundary now lies at element "106," which was discovered simultaneously in Russia and the United States and which remains unchristened in "a spirit of détente."*

But to go from "106" to "107" looks very hard. The next chemical element likely to be found, many people believe, must therefore be significantly heavier, what has come to be known in the jargon as "a superheavy element." This atom is a completely different breed from those known today, something with perhaps 114 protons in its nucleus (uranium has 92) and an atomic mass of 300 (some 40 mass units heavier than anything now known). A superheavy atom wouldn't be all that big compared with ordinary atoms. But the nuclear physics of such an element would necessarily involve heavy doses of relativity, which has led some people to wonder if this might not also mean a bizarre chemistry for the thing. Before thinking about how extraordinary a superheavy atom and its nucleus might be, one must understand more about "ordinary" nuclei.

It was not so very long ago that the nucleus was thought of as a fuzzy spherical blob, which behaved rather like a drop of water. This model was first set forth before World War II by Niels Bohr and John A. Wheeler. Here, a stable nucleus has a spherical form, because only then is the inwardly-directed force of surface tension and the outwardly-directed force of electrostatic repulsion among the positively-charged protons in balance.**

Also produced simultaneously were elements with 104 and 105 protons in their nuclei, and these bear double names—Ruthorfordium and Hahnium in the U.S. and Kurchatovium and Nielsbohrium in Russia.

***Recall that if only electric forces are acting, two protons, having like charges, repel each other.*

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We now know that the nucleus is not nearly so simple and that heavy nuclei, such as that of uranium, can often be highly deformed objects looking like fat cigars. But any *super*heavy nuclei we are likely to find will probably be spherical in shape. In this game, the most stable things are spheres. To understand why, we turn to the nuclear shell model.

During the late forties, Maria Goeppert Mayer in the United States and J. Hans D. Jensen and his colleagues in Germany proposed that, just as electrons move in well-defined orbits around the atomic nucleus, so must there be orbits for protons and neutrons within the nucleus. Moreover, these nucleon orbits are arranged in so-called "shells" which are energetically separated from one another.

Certain nuclei are particularly stable, and these contain what came to be called a "magic number" of protons or neutrons. (The word "magic" means they were not understood at first.) The magic numbers are always even and at least in the beginning seem to be the same for protons and neutrons. They are generally thought to be 2, 8, 20, 28, 50, and 82 in the elements below uranium in the periodic table. (We shall come back to the magic numbers for superheavy nuclei in a bit.)

A good example is helium (^{4}He) with its 2 neutrons and 2 protons. It has long been known that this nucleus is very tightly bound. An extra nucleon simply cannot be added to it to form a stable nucleus: ^{5}He, having 2 protons and 3 neutrons, does not exist in nature, or even as a radioactive nuclide. Nor is there a lithium nucleus with 3 protons and 2 neutrons. As another example, the magic number "8" appears twice in oxygen, ^{16}O, which has 8 protons and 8 neutrons. While it takes a lot of energy to get either a neutron or proton out of this nucleus, the extra neutron in its isotopic relative, ^{17}O, can very easily be pried out.

The stability of nuclei with a magic number of protons or neutrons comes from the fact that their outermost shell of orbits is filled to capacity, in analogy to the filled electron shells of the highly-stable noble gases of chemistry.* Two different orbits, of course, may have different energies, but not always. Imagine two satellites going around the Earth with the same apogee and perigee, but one being oriented in a polar orbit and the other in an equatorial orbit. These satellites have the same energy. They differ only in the direction that their angular momentum vector points.

Likewise, two nucleons can be in different orbits with the same energy. Indeed, one of the determining factors of what the allowed energies for the

**Due to the great stability of their electronic structure, the six noble gases form almost no chemical compounds, but exist mostly only as free atoms. With the exception of radon, their names come from Greek roots—helium ("helios," sun), neon ("neos," new), argon ("argos," inert), krypton ("kryptos," hidden), and xenon ("xenos," stranger).*

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nucleons are, in quantum mechanics, is the magnitude of the angular momentum vector. But not its direction—different directions still correspond to the same energy. All the orbits of a given energy constitute a "shell."

The magnitude of the angular momentum in quantum mechanics is represented by a quantum number l, an integer.* The value of l is important in that it indicates how many allowed orbits (or "states") there are in any given shell. The formula to be used, say the practitioners of quantum mechanics, is that for energy of a given l quantum number, there are $2(2l + 1)$ different orbits available at that energy. (The overall factor of 2 refers to an intrinsic spin degree of freedom, to which we return below).

Solving the necessary equations, we find that the magic numbers for a simple nuclear force corresponding to that of every particle being held in the nucleus by identical springs are 2, 8, 20, and 40, as is shown in Fig. 1. At the first level, the orbital angular momentum, or "l," is equal to zero and therefore the number of states in this shell is $2(2 \times 0 + 1) = 2$. In this

**There is, for those interested in the jargon of physics, a somewhat cumbersome set of names for the various l levels, being a holdover from the beginning days of optical spectroscopy. The $l = 0$ levels are called "s," standing for "sharp," $l = 1$ are "p" for "principal," and $l = 2$ are "d" for "diffuse." For higher values, $l > 3$, the usual alphabetical sequence starting from "g" suffices.*

ENERGY		ℓ	$2(2\ell + 1)$	TOTAL IN SHELL	MAGIC NUMBER
$4E_0$	----------	0	2		
	----------	2	10		
	----------	4	18	30	70
$3E_0$	----------	1	6		
	----------	3	14	20	40
$2E_0$	----------	0	2		
	----------	2	10	12	20
E_0	----------	1	6	6	8
0	----------	0	2	2	2

Figure 1. Magic numbers, Part 1. If every particle were held in the nucleus by an identical spring, the energy levels would be as shown above. Here, ℓ is the orbital angular momentum quantum number for different levels, and $2(2\ell + 1)$ is the number of different orbits in each of those levels.

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level one can stuff up to two protons (or neutrons). If the shell is filled up with *both* protons and neutrons, this is helium sometimes written* as $^{4}_{2}He_{2}$, which is said to be "doubly magic." As mentioned above, ^{4}He is a very stable nucleus. Also it is spherical in shape since there is a nucleon going around in every one of the possible oriented orbits, no particular orientation can be preferred.

At the next level, $l = 1$, giving us $2(2 \times 1 + 1) = 6$ available states in the shell. If we keep adding protons (or neutrons) until this shell is full, we then have a total of 8 nucleons, counting those in the previously-filled lower shell which also must be present. ($^{16}_{8}O_{8}$ is another doubly magic nucleus, especially stable, and spherical.)

The third level has orbits with both $l = 0$ and $l = 2$. The former gives us $2(2 \times 0 + 1) = 2$ states, and the latter gives us $2(2 \times 2 + 1) = 10$ states. And thus the total number of states that can be filled to this point is $10 + 2 + 8$, or 20. (If 20 is the number of both protons and neutrons, we have calcium, $^{40}_{20}Ca_{20}$, yet another doubly magic nucleus.)

The fourth level also has two different angular momenta present. The part $l = 1$ needs 6 nucleons to be filled, that where $l = 3$, 14, for a grand total of 40 nucleons. But—alas!—experimentally, 40 isn't a magic number. You will, no doubt, also have noticed that this picture skips 28, already a confessed magic number. Life in the nucleus is more complicated than that due to forces which are no more than simple springs.

The missing ingredient is the recognition that the nuclear force depends not only upon the position, but also upon the spins of the particles involved. The "intrinsic spin" of a particle is another concept that comes to us from quantum mechanics. Both the neutron and the proton have intrinsic spins of ½. A proton can point "up" (+½ spin) or "down" (−½ spin). So what we have to do is include the spin angular momentum when we calculate the total angular momentum. It was this idea of spin-orbit coupling which won the Nobel prize for Mayer and Jensen. Jensen, however, later confessed that, with the scant experimental data then available, he was not entirely happy with the model. And thus was not too surprised, when a certain unnamed journal refused to publish the initial paper, because it was "not really physics, but rather just playing with numbers."

Spin-orbit coupling is today very much a part of physics. It leads to the total angular momentum quantum number, "j," which is "½," the intrinsic spin of the nucleon, added to our old friend "*l*." Now one possibility for j is $j = l + ½$, which indicates a

** The subscript in the lower left hand corner gives the number of protons in the nucleus (here 2); the subscript in the lower right hand corner gives the number of neutrons (here 2 again), and the superscript in the upper left hand corner gives the total number of protons and neutrons.*

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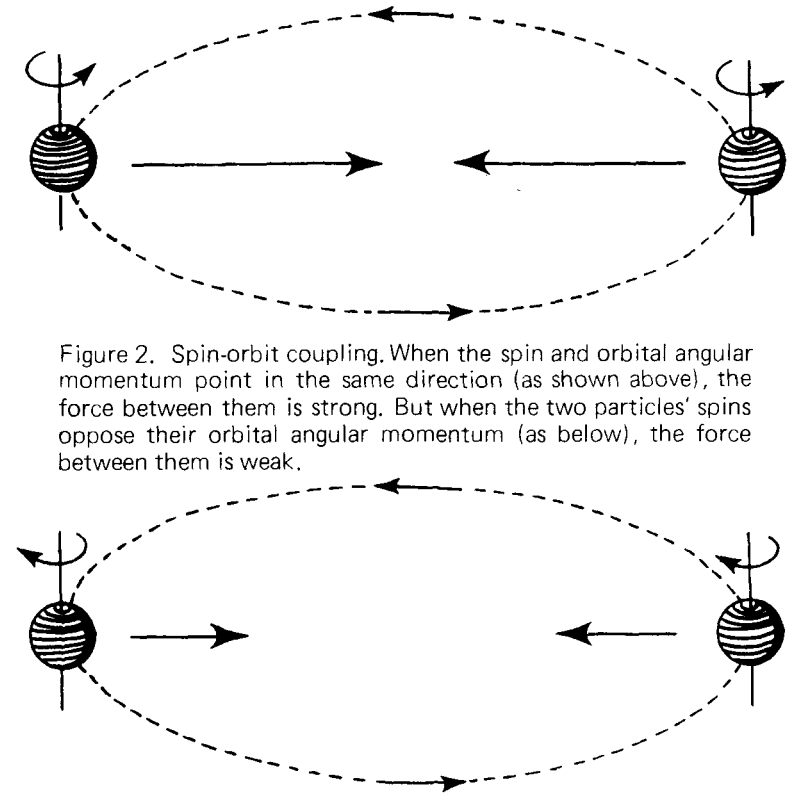

Figure 2. Spin-orbit coupling. When the spin and orbital angular momentum point in the same direction (as shown above), the force between them is strong. But when the two particles' spins oppose their orbital angular momentum (as below), the force between them is weak.

situation in which the spin and orbital angular momentum are pointing in the *same* direction. Likewise, we can have $j = l - 1/2$, where the two angular momenta point in opposite directions. It is a fact of quantum mechanics that these two situations exhaust all the possible ways of adding up the spin and orbital angular momentum.

Now it turns out that, for some still not-well-explained reason, the nuclear force is *more* attractive when the two spin and orbital angular momenta are parallel ($j = l + 1/2$) than when they are not ($j = l - 1/2$). This is shown in Fig. 2). The appropriate energy levels, complete with what is now known to be the necessary quantum number, "j," are shown in Fig. 3. As you can see, the spectrum of allowed energies is now rather more complex than in the simpler case illustrated in Fig. 1. There is, for example, a lot more

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"shell splitting," a phenomenon believed to be ever more prevalent as we enter the realm of the superheavy nuclei. You may want to see how the magic numbers are built up now, using the formula $2j + 1$ for the number of states in every level. With spin-orbit coupling, the magic numbers are correctly predicted, and they are not so mysteriously magic anymore.

It was not until 1967 that the shell model, its now famous spin-orbit corrections, and the liquid drop model were all tied together in such a way that a number of hitherto interesting but not understood facts about ordinary heavy nuclei, such as uranium, were explained. A by-product of this merger was the prediction of the existence of an "island of stability" for superheavy nuclei. (See Fig. 4.)

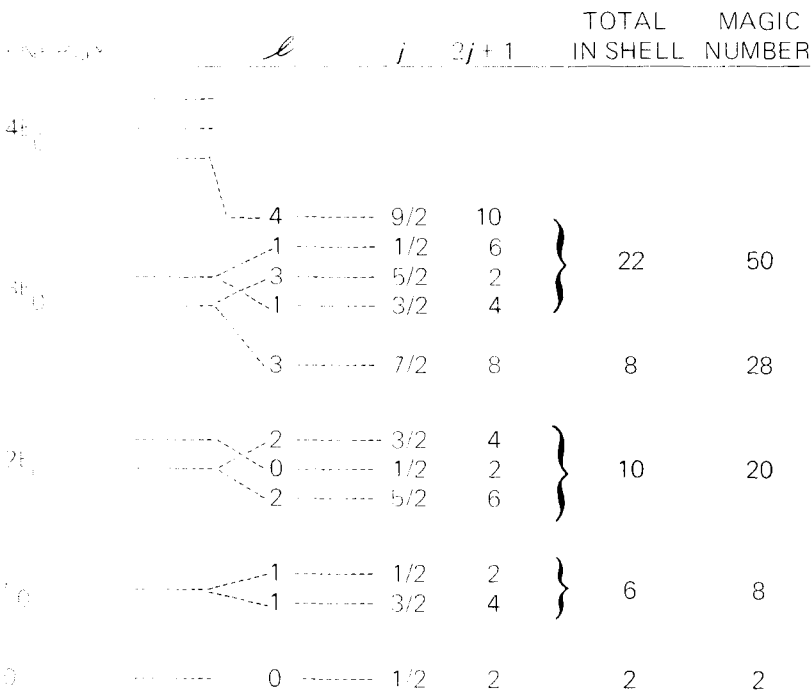

Fig. 3. Magic numbers, Part 2. A more realistic energy level diagram incorporating the spin-orbit force correction of Fig. 2. Here j is the total angular momentum quantum number for any given level, and the number of different orbits in each level is $2j + 1$. Note there is a good deal more shell splitting here as compared with Fig. 1.

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Among other things, the suggestion emerged that a stable doubly-magic superheavy nucleus might exist, with 114 protons and 184 neutrons.* Previously, one might have naively supposed "126" to be the leading candidate for a proton magic number, since this number is known to be magic for neutrons.** Lead, $^{208}_{82}Pb_{126}$, is a very common substance, doubly magic, and hence highly stable.

This prediction was extremely important in the history of the theory of superheavy elements. It encouraged experimental physicists to hope they might be able to find or fabricate a superheavy element since "114" is not *so* far beyond presently-known elements. With the acceptance of "114" as magic came acceptance of the fact that "nuclei may have separate (but equally stable) magic numbers of protons and neutrons." This parting of the nucleonic ways is due to the increasingly important role the repulsive electrostatic force between protons plays toward the end of the periodic table.

Only one more thing was needed to convince experimental physicists that superheavies were more than "an amusing idea"—some indication that such beasts would live long enough to make a search worthwhile. Calculations indicate that the lifetimes of nuclei immediately beyond the still unnamed "106" are quite short, perhaps much less than a second. Because of this, elements after "106" are rather facetiously said to form a "Bay of Pigs" on our "Map of Isotopes," (Fig. 4 again), and we will talk more about the implications of this "bay" later on. All too obviously, if a nucleus were to be born and die in such a short time span, we could never hope to find it. But in 1968, theoretical physicists assured us that heavier nuclei out beyond the "Bay of Pigs" on the promised isle have sufficiently long-enough lives to be observable. "Sufficiently long" might even mean a lifetime of the order of 10^8 years.*

Whether or not a new nucleus is stable enough to be observed depends, in reality, on how quickly it would decay. This decay can take place several ways but one mode of particular interest is spontaneous fission. "Fission" is a word ofttimes associated with uranium. If a nucleus of $^{235}_{92}U_{143}$ absorbs a passing neutron, this added neutron causes an instability in the nucleus. It begins to wobble. This vibration causes the nucleus in turn to stretch out into the form of a dumb-

One unofficial name is "Gammelgormium," appropriately abbreviated "Gg." "Gammel" is Danish for "old," and "Gorm" means "giant."

***These proton and neutron numbers, of course, are only expected to be magic (shell-closure) numbers on theoretical grounds. In addition there might exist nearby nuclei which are only singly magic, i.e., not quite so stable, but stable nonetheless.*

**In this notation, 10^8, which means 10 raised to the eighth power, is 100 million years. Four billion years is written as 4×10^9, and this is how long ago the earth's crust was formed.*

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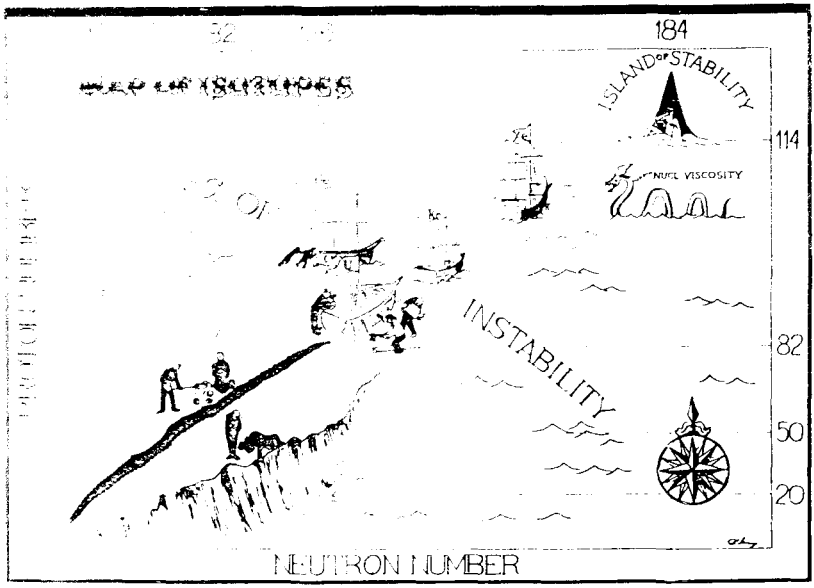

[illegible] 4. [illegible] of Isotopes." This allegorical statement of the problem of [illegible] comes from Professor G.N. Flerov of Dubna, USSR. [illegible] and on sea are man's various heavy-ion accelerator [illegible] the promised "Island of Stability." The infamous "Bay [illegible] is in the vicinity of "The Good Ship Xenon." Because Dr. Flerov [illegible] to embarrass us, this bay is not so named in this Russian [illegible]

bell (as would an excited drop of water), and the nucleus splits into two pieces.

Denoting the excited intermediate nuclear state with an asterisk, a typical fission process is

$$n + {}^{235}_{92}U_{143} \longrightarrow {}^{236}_{92}U^{*}_{144} \longrightarrow {}^{138}_{54}Xe_{84} + {}^{95}_{38}Sr_{57} + 3n,$$

where Xe is xenon and Sr, strontium. Notice that, as an end product, there are 3 neutrons left over. Ordinarily, neutrons are needed in the nucleus to overcome Coulomb repulsion between the positively-charged protons, and stick all the nucleons together in the nucleus. But now that there are two fission fragments, each smaller than the parent, so many neutrons are not needed to keep things together.

These excess neutrons play an important part in our story.* While naturally-occurring nuclei emit, on the average, only 2 or 3 neutrons per fission, a superheavy nucleus is ex-

**And other stories—they are also the reason why we can make chain reactions go and thus build atomic bombs and nuclear power reactors.*

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pected to emit perhaps as many as 10 per fission. Because of the larger kinetic energy carried by the fragments, the tracks from superheavy elements fissioning should also have greater lengths. Experimental physicists have thus been seeking both the neutrons and/or fragment tracks as evidence that a superheavy nucleus passed away—i.e., decayed by fission. Their premise is, that as the nucleus becomes ever larger, the probability of fission increases.

This can, moreover, be a fission *without* the addition of an extra neutron to tickle the nucleus and get the process started; this is "spontaneous fission." The larger nuclei simply come with built-in instabilities, that is to say, they are always wobbling, and every once in a while, the wobble becomes great enough to bring about decay by fission. For the trans-uranium elements einsteinium, fermium, and mendelevium (with 99, 100, and 101 protons respectively) and for all other elements up to that with 106 protons, spontaneous fission is known to be the most important method of decay.

By 1968, convinced that some superheavy nuclei survive long enough to be detected, the search was on. A year later, the first reports came dribbling in. Unsuccessful searches had been made for eka-platinum with 110 protons. (The Mendeleevian prefix "eka" is Sanskrit for "first," and tells us that this element with 110 protons is expected to behave chemically like a first cousin of platinum with 78 protons.) And for eka-lead with 114 protons. The rationale then—as now—was to assume that superheavy elements chemically and geophysically follow their lighter homologous elements.* Thus, one might expect to find eka-lead in lead-bearing samples. At one point, the Russians suspected a piece of 18th century lead glassware garnered from a church of harboring a superheavy element. But the results were irreproducible: other samples of lead glassware were etched and no fission tracks found.

Experimentalists have also looked for those neutrons that could come from spontaneous fission of superheavy elements in several hundred different kinds of samples. The samples have included both raw and pure metals as well as ores and their various and sundry by-products. While the people doing these experiments often had a complicated argument for looking where they did, this was not always the case. Sometimes they looked because the sample, like the proverbial mountain-to-be-scaled, was "there."

Among the various samples: 60 million-year-old sharks' teeth from a depth of 15,000 feet in the Pacific Ocean, native bismuth from Saxony in Germany, a core drilling sample

**This may, it has been suggested, be one of the ideas leading us into trouble. Just as the chemistries of silver and gold or tin and lead differ from each other, so too may "115," eka-bismuth, for example, differ from that of bismuth.*

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from El Paso Natural Gas Co. (Wagon Wheel No. 1 in Wyoming), lead-bearing hardystone and gold-bearing quartz almost as old as the Earth itself, and, of course, samples from the Moon. All in vain—no evidence was ever found for very energetic fission neutrons that would indicate a superheavy element's demise.*

In hopes of finding superheavy elements impinging on the Earth from outer space, a number of cosmic ray searches have also taken place. It was while unsuccessfully looking for a superheavy element that physicists reported finding the tracks of a magnetic monopole (Analog, Nov. 1976).

There are, however, two intriguing possible scents of superheavy nuclei in the wind. Neither set of evidence is compelling enough to convince us we have reached the promised island. Both involved puzzles that are not easily explained by now-known elements, and some people gradually came to believe that superheavy elements were at the root of the puzzles.

We have already mentioned the group of Americans, who claimed evidence in the summer of '76 for superheavy element "126" (and perhaps three of its brethren). Their report suggested the elements may have been sitting around in naturally-

**And one physicist has concluded that superheavies are like angels—potentially useful but impossible to find in nature!*

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occurring monazite inclusions embedded in Madagascar mica for some 10^9 years. Moreover, the superheavy elements were said to have advertised their presence by building "giant halos" about their tiny crystal homes in the surrounding glassy medium. This claim followed on the heels of earlier suggestions that superheavy elements may have been incorporated in the chemical makeup of certain extraterrestrial visitors called "carbonaceous chrondrites," the most famous of which is the Allende meteorite.

Robert Gentry of Oak Ridge National Laboratory is probably the world's leading expert on giant halos. Halos are, as their name implies, rings around thorium or uranium-rich foreign bodies embedded in glassy minerals. Some few of these are called "giant," and they are large in comparison to the more common dwarf halos, but they still are not visible to the naked eye. Halos are in reality radiation-damaged areas—most are caused when thorium and uranium in the inclusions decay by emitting alpha particles (which are in fact the nuclei of helium atoms).

Giant halos are quite rare. Of the thousands of mica samples Gentry examined, only one included these extra-large halos. Those he found he felt could not be made to fit the accepted pattern; that is, they couldn't be explained by thorium or uranium decays. While their three-dimensional structure implied a radioactive origin, alpha decay would require an alpha particle energy of some 14 MeV, an impossibly large energy for the decay of any known radionuclide.

So Gentry, together with colleagues, decided to bombard these halo-containing mica samples with low-energy protons, to see if a superheavy element was lurking in the background. Taking advantage of an X-ray window, this bombardment would hopefully yield an X-ray spectrum, which would match up with earlier theoretical predictions for superheavy elements and basically determine the charge on the nucleus.

Six inclusions with giant halos were examined, five having been removed from the mica to avoid "background noise," the sixth, "in situ." The group saw one weak X-ray line for three of the four reported elements, and two very weak lines for the fourth. On the basis of this, they called element "126" a "certainty," and elements "116," "124," and "127," "possibilities."

Some physicists have been quick to criticize the experiment.* A German group, based in Heidelberg and Darmstadt, set out to repeat the experiment to confirm (or destroy) these claims. The group used monazite sam-

**Others have set forth proposals to corroborate it. One imaginative physicist hopes to track down "116" by going fishing. Since marine invertebrates slurp up and concentrate polonium, their livers might* also *show traces of eka-polonium, he says. What this would do to the market for lobsters, crabs, and shrimp is unclear.*

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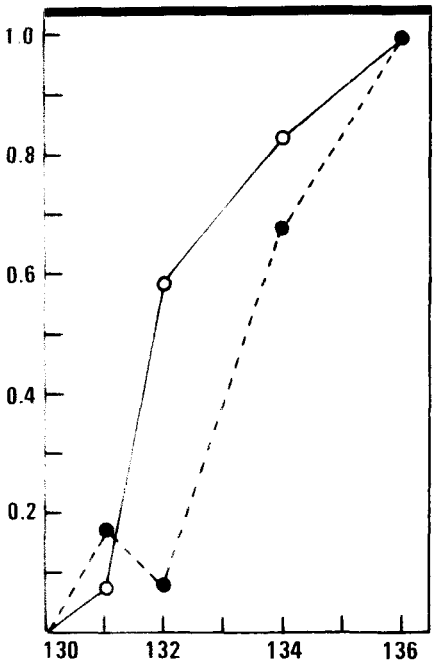

Figure. The Allende meteorite puzzle. The relative abundances of xenon isotopes as they occur in this meteorite are plotted as the solid circular points. Notice the steep rise from ^{131}Xe to ^{136}Xe. No known element that decays by fission, appears in this spectrum. The open circles give the isotopic xenon abundances as they would be had it been ^{238}U which decayed by fission.

ples from various sources, as well as some left in Germany several years ago by Gentry. And found nothing to indicate the presence of superheavy elements. The plot deepens, however. It seems the samples this group used were not quite the same as those investigated by Gentry and his colleagues, but came 10 kilometers away from where the mica with the giant halos was found.

Nonetheless, the German group says the "structure" in the X-ray window reported by Gentry's group as element "126" was inadvertently caused by the group's own proton beam. This "structure," the Germans say, only comes into being when higher energy proton beams are used. The reaction the Germans think is responsible for the halos is

$$p + {}^{140}Ce \longrightarrow {}^{140}Pr^* + n$$
$$\longrightarrow {}^{140}Pr + \gamma,$$

where the rare earth element cerium (Ce) is hit by a proton, transforms into another rare earth element praeseodymium (Pr), and a neutron, and praeseodymium, being in a particular excited state then decays by emitting a gamma ray (that is, a nuclear version of an X-ray). The clincher of the German argument is that when they bombarded pure cerium samples (cerium is present in monazites), they were able to reproduce an "X-ray spectrum" something like what Gentry's group saw. Thus the Germans conclude the "structure" can be interpreted in terms of normal nuclear physics without "stretching the point" to include a superheavy element.

Shortly after the German group reported its results, a French and Polish group handed in a similar report. This group approached the problem in a rather different manner, using a mass spectrograph as its investigative tool. The group's samples

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were monazite from "Col de Monangothry" near Fort Dauphin, Madagascar, which is the same place where the giant halos were found. While the samples contain no giant halos, the group says it feels their composition is "very similar" to those of Gentry and his colleagues.

Briefly, what the French-Polish group did was to evaporate a gram of sample in an "oven." The ions in the mass region where superheavy elements are expected were then collected on a quartz plate which, after a subsequent neutron irradiation in a nuclear reactor, acted as a detector of fission tracks. Some 10^9 atoms of superheavy nuclei so collected, as expected on the basis of the Gentry report, would yield about 1,000 fission tracks. But nary a peak that could be attributed to a fissioning superheavy element did the group see.

Well, if superheavy elements don't live all *that* long to be sitting around today, maybe they were nonetheless sitting around back then when the solar system was being assembled? Edward Anders of the University of Chicago, working with a number of his collaborators, has put together a detailed chemical scenario for the Allende meteorite, which was published late in 1975. In this, they suggested that the superheavy element 115 (or 114, or 113) may have indeed been present when the meteorite was formed.

Meteorites represent the most primitive samples of the solar system in existence. When the solar system was formed out of a cold cloud of interstellar gas and dust, so too were stony meteorites like that which fell in a blaze of blue-white light at Pueblito de Allende in Chihuahua, Mexico, in 1969.* Thus these meteorites were formed before the oldest rocks on the surface of our planet (or that of the Moon) had even crystallized. And minerals in them would be some 4.6 $\times$ 10^9 years old.

The thing that is strange about the Allende meteorite is the presence of xenon isotopes that most probably resulted from some heavy element that fissioned. The puzzle is nicely elucidated in Fig. 5, which shows the relative abundances of various xenon isotopes, compared with the known relative abundances for fission products from ^{238}U. The Allende meteorite has relatively higher ratios of the heavier xenon isotopes than would be expected on the basis of our experience with how elements fission. The ratio of ^{136}Xe to that of ^{134}Xe, for example, is too high to be accepted as coming from the fissioning of any known element. Thus, goes the argument, the progenitor of these xenon isotopes must have been an unknown element. An extinct superheavy ele-

**Some of the many pieces of this meteorite conveniently fell near the post office in Pueblite de Allende, and telephone calls from there set into motion an extensive search for other fragments. Within twelve hours, a U.S. Air Force B-57 was collecting air samples, which had in the meantime drifted over the Gulf of Mexico, using special filter traps.*

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ment would conveniently explain the xenon isotope. But *which* superheavy element? Whatever it was, it had to be incoporated into the Allende meteorite when it was formed.

Present in samples of the meteorite are heavy noble gases (argon, krypton, and, naturally, xenon) and a number of volatile, sulfide-seeking elements. This latter list included thallium, bismuth, lead, bromine, and iodine. "Volatile" means that these elements all have rather low melting points. A volatile element such as mercury is, for example, a liquid at room temperature. Because the elements contained in the meteorite are volatile, it seems reasonable to suppose that any now-extinct superheavy element was of the same ilk. An extended look at the periodic table establishes the progenitor as most likely to have been eka-bismuth (115 protons), eka-lead (114 protons), or eka-thallium (113 protons).

But chemistry alone cannot make an airtight case for the existence of this or any other superheavy element. Chemistry sees the world in terms of electrons. It is electrons which give elements their chemical characters. The number of electrons in any atom in turn is equal to the number of protons in the atomic nucleus, but the number of neutrons is undetermined. In the case of the Allende meteorite, we cannot, moreover, write down a physical reaction for what happened. All we know is that an unknown superheavy element may have decayed, leaving, as an end product, an isotope of xenon,

$$^{?}_{115}X_{?} \longrightarrow ? \longrightarrow ? \longrightarrow ? \longrightarrow {}^{136}_{54}Xe_{82} + ? + \textit{neutrons}.$$

The superheavy progenitor, for example, may not have immediately fissioned. It may have spit out an alpha particle. This "new" element then might have picked up an electron to transform itself further. The alpha decay might have been repeated. Or another electron captured. Finally, something spontaneously fissioned. Unless we can come up with the long-lived superheavy element which began the whole process, we shall probably never know what happened, in detail. And without that detail the evidence from the Allende meteorite is unfortunately not all that convincing.

Apart from the question of whether superheavy elements exist (or existed once) in nature, could mankind take a giant step "across the water" and make one? Ordinary very heavy nuclei can quite simply be made by force-feeding a heavy nucleus a neutron to make a new, heavier nucleus, and then feeding that new guy another neutron, etc. This works quite well as far as we've gone, that is, up to nuclei with 106 protons, which is where today's periodic table ends. But after "106," what? As mentioned, heavier elements from "107" to "114," the first magic number, are expected to be highly prone to spontaneous fission. One must thus figure out a way to bypass these unstable nuclei, to jump over this "Bay of Pigs" of spontaneous fission.

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One way may be to accelerate heavy ions (ions are atoms stripped of some or all of their electrons) and use these to bombard target nuclei in such elements as thorium and uranium. The hope is that the accelerated ions and the target nuclei will fuse together, and a stable superheavy nucleus will be found in the reaction products that result. It was this hope, in fact, that has led to the construction of heavy-ion accelerators here and abroad.*

Physicists have written down a number of heavy-ion reactions, which they consider reasonable methods for producing superheavy elements. To make elements "114," for example, one might use the reaction

$^{132}_{54}Xe_{78} + {}^{238}_{92}U_{146} \longrightarrow {}^{298}_{114}X_{184} + {}^{72}_{32}Ge_{40}$,

wherein a xenon ion is used to bombard uranium, to give us the superheavy nucleus "X" and an ordinary germanium nucleus as products.

Quite obviously, high energies are needed to do this. For otherwise, the repulsive force between the very large positive charges in the xenon projectile and those in the target nuclei would prevent them from getting close enough to each other to touch and fuse. In this case, the xenon ion must be accelerated to more than 500 MeV to have a sufficient amount of energy to overcome the electrostatic repulsion and fuse with uranium.

The biggest problem in doing this is that up to now no machine exists that can do it. Moreover, we don't know how often a reaction like this is likely to produce a superheavy nucleus compared with how often a huge number of other possible outcomes occurs. It may only happen so infrequently that the desired superheavy nucleus is never noticed at all in the noise and confusion of competing processes. For, ideally, the superheavy nucleus must be formed in a spherical shape, and it must have only a small angular momentum and small excitation energy. (Otherwise, it fissions.) Highly excited nuclei in high temperature states simply do not end up in stable ground states. And stability is what we are seeking.

If mankind is going to have trouble jumping to the island of stability, maybe we should return to the question of whether Mother Nature can. Current theory has it that only the very lightest of elements—hydrogen, helium, a little bit of lithium—could have been synthesized in the primordial fireball, the initial "Big Bang." All heavy (and superheavy) elements must therefore have been produced later in the stars. Ordinary main-sequence stars, where hydrogen is fused into helium for fuel, offer no hope of leading us to superheavies. Nor do red giants which fuse helium

Sad to say, these accelerators were not funded for purely humanitarian reasons. Because a small amount would be enough to create a so-called "critical mass," superheavy elements have weapons applications. With their discovery, one could conceive of something the size of a hand-gun with "bullets" which are really atomic bombs.

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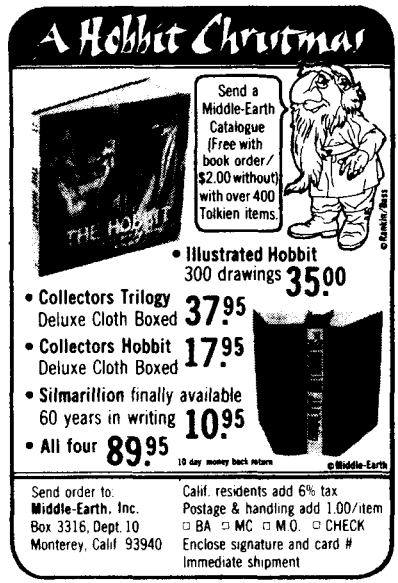
into carbon. It is not surprising that, for superheavy elements, we must look to cataclysmic astronomical events, to supernovae and to their remnants, neutron stars and black holes.

The nuclear reaction process that one might hope would ferry us across to the long-sought island is called "the r process," "r" being the mnemonic for "rapid." This process takes place where the neutron flux is at its most intense, i.e., in the region of a supernova just outside a neutron star or black hole remnant. Neutrons are absorbed rapidly, one after another, and regions of instability are thereby thought to be bridged. All elements heavier than bismuth are believed to have been formed in this way.

Some physicists, however, question the ability of the r process to "cook up" superheavy elements. At issue is the rate at which the resulting highly radioactive neutron-rich elements beta decay. (Beta decay involves emission of an electron and a neutrino. To conserve charge, a proton is left behind.) Should any element so produced beta decay too often, it founders, falling back to a point where spontaneous fission takes over (that awful "Bay of Pigs" that keeps causing all the trouble). The question is therefore, what mechanism in the r process would prevent such backsliding. Perhaps, indeed none can.

But nature may—in her complexity—choose a more exotic way. From Cambridge, England, comes the idea that superheavy elements could probably exist (and/or be synthesized) in the outer layers of a neutron star. And the neutron star might be induced to spew them out into the surrounding universe. Suppose, the authors of this conjecture say, a black hole were to brush by the neutron star, swallowing up most, but not all of it. Disrupted, the remainder would release already-formed superheavy elements, or enough neutrons to produce them. (Remember, finding a lot of neutrons all at once in one place is not an easy task.)

Or, in what is called "a more likely plot," a neutron star greedily eats up so much material that it is no longer stable. It collapses to form a black hole, throwing off outer layers—and perhaps superheavy elements as well.


A Hobbit Christmas
Send a Middle-Earth Catalogue (Free with book order/ $2.00 without) with over 400 Tolkien items.
• Illustrated Hobbit 300 drawings 35.00
• Collectors Trilogy Deluxe Cloth Boxed 37.95
• Collectors Hobbit Deluxe Cloth Boxed 17.95
• Silmarillion finally available 60 years in writing 10.95
• All four 89.95
10 day money back return
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A variation on this theme yields up the elements in question without the black hole: the central regions collapse to neutron star densities, give birth to superheavy elements, and then bounce, leaving no remnant of neutron star behind.

With that discussion in mind, there might also be an exotic way available to inventive mankind. To use thermonuclear bombs and laser-fusion devices might circumvent many problems. This suggestion comes from a group of southern Californians, who want to try controlled sequential neutron capture. The secret of their "recipe" is allowing elements so produced to beta decay just the right amount between exposure to neutrons. At least one of the group has, however, admitted the idea to be "naturally speculative at this time."

Let us see how one might proceed, given the technology. The idea in this case is to stay in the "neutron-rich marshes" and detour *around* the problematic bay of spontaneous fission, rather than trying to bridge it. The Californians suggest exposing ^{238}U and ^{242}Pu in a special type of underground thermonuclear device. When a thermonuclear bomb is set off, it produces as a by-product an enormous flood of neutrons. The theoretical model tells us the neutrons will be captured all at once—i.e., within a few microseconds—by the uranium and plutonium, and neutron-rich elements formed.

During the first step, one might hope to pick up as many as 30 neutrons, to form elements with anywhere from 93 to 97 protons and 174 neutrons. The target with the neutron-rich elements, very radioactive, would then be quickly reexposed in a laser-fusion device in a laboratory, which is a more controlled way of producing a flood of neutrons. This time it would be transformed into elements with perhaps 107 protons (a net gain of from 10 to 14) and maybe 180 neutrons (a net gain of 6). Now if the element could be encouraged, in yet another exposure to the laser-fusion device, to capture 10 or so more neutrons and undergo a few more beta decays, we would be home free. We would have reached the promised shores of stable superheavy elements.

Well, maybe. If we ever successfully land a ship on the island of stability, what next? There might be yet another island offshore of that one. Some far-seeing physicists are already speculating about "164" as the next magic proton number. It should be pointed out, however, that the stability of closed nuclear shells cannot extend the periodic table of elements forever. Electrostatic repulsion between the protons will at some point become all too important. Perhaps, however, gravity might eventually come in to help. A neutron star is, in some sense, a super-duper-heavy nucleus, held together more by gravity than by nuclear forces. But who among us would be so bold as to proclaim a neutron star as one of the chemical elements? ■

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REACTION TIME

Laws are written to protect . . . who?

L.E. MODESITT, Jr.

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Mike Throne tossed the red-edged envelope at the autodesk.

"Damn! Damn! Damn! First they give us the contract. Then every two-bit government inspector has to butt in."

Throne looked out the trailer window at the littered dirt, called urban reclamation by the contract . . . and at SEX, the Super Excavator, lying idle at more than $2,000 a day in depreciation. SEX was designed to build the twenty-four foot sound pollution reduction berms required for new construction developments by the EPA. The self-programming machine stood over forty feet tall and could throw up a packed and finished berm at almost two miles an hour.

Mike Throne was also committed to a year's lease on the beast, as well as on the companion machinery. He'd been waiting four months to move dirt.

Throne turned back to the autodesk.

"It's insane, just insane," he muttered. "Why am I in this business? Here it is, August first, and I was supposed to start in April.

"I can clear the land, install the utilities, put up the berms, and pave the streets in two weeks. I spend more time waiting than working. More time on inspections and reports than building."

He glanced at the autodesk again, then at the bookcase. All the reports were there—Socioeconomic Impact Statement, Environmental Impact Statement, Construction Noise Prevention Plan, Emissions Control Plan, Job Accident Prevention Plan, Federal Overtime Prevention Plan, Purchaser Equal Opportunity Plan, Social Services Impact Plan, Tax Revenue Projection Statement, Projected Domestic Animal Control Plan, Energy Conservation Projection, City Services Impact Statement, Demographic Projection Agreement . . .

There was a thump on the door.

"Yeah?" growled the builder.

A scraggly blond teenager slouched in.

"Hi, dad. You busy?"

"Nope, just swearing."

"You heard what the Congress is up to today?"

"You aren't watching that trash again?"

"It's better than the soaps."

Throne, junior, grinned at his father.

"Anyway, they're talking about requiring a lifetime guarantee on new housing by the builder . . . say the present fifteen year unconditional one isn't enough. Builders aren't paying any attention. When they go bankrupt, the buyers are left in the lurch. So they want to set up a trust fund that all the builders pay into . . ."

Throne sat down. His son saw the look and left, closing the door quietly.

The builder began dictating figures to the desk.

"Feel so damned walled in," he groused. "Just wish they had to build and were walled in with their own regulations."

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He looked out the window at SEX.

"Projections not feasible," commented the desk.

Mike stared out the window. He smiled. Then he began scratching out figures on his yellow pad.

Devon O'Neill, night engineer on watch at the MacArthur Boulevard waterworks, was the first functionary to learn about the wall. She didn't learn that was what she learned until she tried to drive home at the end of her shift.

At 10:29 PM, Friday, August thirteenth, she lost all pressure on the main line to the District somewhere between stations eight and nine. She verified the operation of the automatic shunts, shut down the pumping stations, logged the failure and called the emergency repair crew and the chief engineer.

Officer Slade Brown was the second functionary involved, but only by minutes. Brown was off duty, moonlighting as a guard at the New Hampshire Avenue Rufburger, when he heard the roar of heavy machinery.

Loyal to the D.C. ordinances and the Federal Noise Act, Brown charged out of his plastic oasis to find the SOB, Self-Ordered Bulldozer, clearing a one hundred foot right-of-way along Eastern Avenue.

"Do not panic. Please move your vehicles and your persons. I am a Self-Ordered Bulldozer, programmed to clear this area. I cannot be responsible for your safety if you remain within my operating area."

Brown's jaw dropped. Up the street he could see other machines. He studied the safety operator's cab of the SOB. Plates had been welded over the entire cab.

Slade Brown watched the wall of earth move down Eastern Avenue for another minute before he phoned the dispatcher.

Lieutenant Davis Wontara, special projects officer of the D.C. Police, inherited the mess. He arrived at Ward III headquarters at 12:15 Saturday morning.

"Lieutenant, Lieutenant . . ."

"All right, all right. So we got construction machinery running around loose. Is that any reason to drag me down here?"

He shook his head, then pointed at the desk man.

"What do you know, Symms?"

"We've got reports that somebody's building a wall up Western Avenue. Somebody else is building one down Eastern Avenue, and there's another one going up out by Southern Avenue."

"In or out of the District?" asked Wontara pragmatically.

"Inside. They're staying in the streets pretty much, broadcasting warnings, but they've buried a bunch of cars."

"Why didn't somebody just order them to stop?"

"They're all self-programming robots."

Wontara scratched his balding dark forehead. "Maybe I'm asking dumb questions, but why doesn't somebody

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just climb up on the damn things and turn them off?"

"Sir?" asked a patrolman from the back of the room.

"Well?"

"I was with Hejaz when he tried it. He used a programmer. Thought it would be a piece of cake. But somebody welded over the safety operator's cab with half-inch plate. Hejaz borrowed a cutting torch and tried to get at the inputs. The antivandalism circuits zapped him. He's still at Sibley, but the doctors think he'll be back in a few days."

Wontara scratched his forehead again.

"Why would anyone want to build a wall around Washington?" the lieutenant muttered.

"Okay." He paused. "Find out who owns the equipment; get a warrant for their arrest. Use destruction of city property, vandalism, whatever, but get them. In the meantime, let's see if we can figure out some way to shut them down. Oh . . . and somebody . . . you, Symms . . . call the White House."

He sat down, still scratching his forehead.

Hegallant, special projects, looked up at SEX, the super excavator.

"Come on, Hegallant. Come on. Is there anything you can do? Anything you can disconnect? Anything at all?"

Hegallant peered behind the shifting twelve foot treads, walking slowly to keep pace with the machine. He flicked the high intensity beam back and forth, from the heavy plates to the recesses underneath.

"Sergeant, I can't see anything down here but plate and armored cables. All the disconnects are wired . . . and the wires are armored." Hegallant wondered how they'd found out about his heavy equipment background . . . the summers with his uncle's firm in Indiana.

"Wired?"

"Yeah. If you touch them without clearance from the program or the safety operator, you get blasted with a pretty high voltage." He kept probing with the light.

"Why they'd do that?"

"If you had a couple million bucks tied up in this baby, you sure wouldn't want some dude to undo a fitting for kicks and freeze up the whole damn thing." He kept pace with the machine. It was bigger and looked tougher than the M-75's he drove in summer camp.

"Hey, Sergeant, am I supposed to keep this thing company all the way down Eastern Avenue?"

"Can't you do anything?"

"Sure. With an access key or some demolition. Even a small bomb, or one of those high-powered military electronic scramblers . . ."

"Okay, okay. I told you. No bombs. You want to blow up the crowd and all the houses along here? Look . . . you and Alrammaden make sure everyone stays back. All we need now is some nut to get squashed."

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"Right," sighed Hegallant. "Right."

"Okay there, all you night-owls. That was Goldie and The Rainbow's End with their new release 'I Wish I Were A Unicorn.' I'm Coyote Carl here with you till the sun peeks over the morning smog. And speaking of smog . . . here's officer John Law with a midnight traffic alert, another first from WISH, station of the stars."

"Thank you, Carl. I really can't believe this. Weekend construction has blocked a large number of the major ways in and out of the District. It's bad out there now . . . and it's just beginning.

"For starters, MacArthur Boulevard, River Road, Wisconsin Avenue, and the D.C. George Washington Parkway are all blocked at the District Line. Cars on the beltway are already backed up as far as Gaithersburg. Western Avenue is closed from Westmoreland Circle almost to Sixteenth. Connecticut is closed at Chevy Chase Circle.

"Riggs Road and New Hampshire are blocked at the District line. South Capitol is still clear, but Pennsylvania and Benning Road are closed at the D.C. line. So is East Capitol.

"The Potomac Bridges are still open, but they're a real mess. They're all filled with cars. The Fourteenth Street Bridge isn't moving at all.

"If you're in the District, I think you're going to stay in. If you're out . . . well . . . you're out.

"As we find out more, we'll keep you posted. Now back to you, Carl."

"Time for Diminutive Douglas Dolittle and the Great Accordian Spaceship with their version of 'Lock Me Away' . . ."

The three sets of machines belonged to Throne, Crowbar and Company; Grubb, Roott and Hogg; and Overcharge Construction.

By two o'clock Wontara had finished the coffee pot and polished away at least one layer of skin on his forehead.

Grubb, Roott and Hogg was an international outfit based in Zurich. The local office had an answering service. After a dozen calls, Wontara located Sondra Wagler, the local president's administrative assistant. Hoagland Mitchell, the president, had left the afternoon before on a family vacation. He'd not left a number, but said he'd call in periodically. Sam Hall had the override programs to the heavy equipment and the remote terminals.

"Sam Hall?" asked Wontara.

"Yes, sir. Mr. Mitchell said he was changing all the codes. He was worried about industrial labor problems, he said, and Mr. Hall had been hired to look after the equipment in his absence."

"Wasn't that a little unusual?"

"Yes, sir. Normally Mr. Mitchell doesn't let anyone have the codes or the remote frequencies . . . at least not in the three years I've been here."

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"Have you ever met Mr. Hall?"

"No."

"Can you give me his number?"

"Sir, I don't have it. He's not on the company roster."

Wontara scratched his head again. He was still thirsty. Dolores was going to be mad and then some. Another Friday night, for heaven's sake. He leaned back in the swivel chair. He felt grubby, especially after seeing Captain Horsclose in the hallway,

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(signed) Harold G. Meyer, Vice President of Owner

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I certify that the statements made by me above are correct and complete.

(signed) Harold G. Meyer, Vice President of Owner

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clean-shaven as always, neat and dapper.

"Lieutenant, no luck with Overcharge. High-powered international outfit headquartered in Denver. Local manager named Pierre Gourmand took off for Paris last night. He turned over the equipment codes to a new assistant named . . ."

"Sam Hall," finished Wontara.

"How did you know?"

"It figures."

The answering service at Throne, Crowbar and Company had finally referred Wontara to a junior engineer named Quillan.

"Do you know why Mr. Throne is out of town?" demanded Wontara.

Quillan coughed. She was hoarse.

"Look, Lieutenant, I don't know any more than you do. Mr. Throne said he'd had it with all the delays. He was going off where no one could find him. I asked him about the equipment. I've used the remotes, but he's always kept the access codes and the frequencies. That's the one thing he never delegated . . . the heavy stuff, you know. He just said, 'Sam Hall's got it from here.'"

Since Mitchell, Gourmand, and Throne all lived outside the District, Wontara called the FBI, explained the situation, and left the names with the duty officer. Wontara walked out of the briefing room for coffee. He called in sick from home twenty minutes later.

Colonel Robert Sterile, coordinator of the War Plans Office, and Pentagon duty officer Friday night, was jolted by the alarm from the Comm Duty Officer.

"Colonel, we've just lost land lines out of Bolling and Aberdeen."

"Any problem with the secure lines, any of the lines to Superlight?"

"No, two regular trunks. I can't ascertain with the information now available, but it appears as though the affected lines are only those routed through the geographical boundaries of the District of Columbia."

"Roger. Keep me posted."

Colonel Sterile settled back into his *Semantics Of Command* when the alarm sounded again.

"Colonel, Hennesy, PAO duty officer. We're getting reports that somebody's building a wall around the District on the Maryland side."

"Let me know if you hear more, Hennesy," replied the Colonel, picking up the book again.

"Yes, sir. But Hardnose from the *Post* is calling in. He wants to know what we're going to do about it. Or if we're doing it."

"Of course we aren't!"

"Can I tell him that?"

"Sure . . . well, maybe you'd better not."

"And, sir, they say there's construction machinery, big stuff, bigger than our M-75's, building that big earth wall along the District line."

"Stall them. I'll get back to you."

The Colonel grabbed the Intelligence Hotline.

"Sterile, OPSWATCH. Wall being constructed along the District line.

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Confirm this story ASAP."

"Roger, OPSWATCH, roger," returned a bored voice.

Sterile drummed his fingers on the console. He looked at the clock. 0145. He picked up *Semantics Of Command,* marked his place with a toothpick, and closed the book. He typed the log entries into the console, one finger at a time.

Sterile winced at the shrill ring of the Intelligence Alert.

"Colonel Sterile, this is Birdseye in the Catbird Seat. Advise you alert Superlight. Recommend Phase One ENDGAME. Confirming your report 0143. Three embankments approximately eight meters high under construction along District line. As of 0130 approximately 30 kilometers complete. ETC 0345 with a possible deviation of plus or minus 30 minutes."

"Roger."

Sterile reached for the Yellow Hotline.

"General, Colonel Sterile, OPSWATCH. Unknown individuals are rapidly constructing a wall around the District. Birdseye recommends Superlight Alert and Phase One ENDGAME. I'd also suggest HIDEYHO to be safe."

"Are you crazy, Colonel?"

"Yes, sir. I mean, no, sir."

By 2:30 AM Saturday morning, the Throne, Crowbar and Company SEX was crossing New York Avenue, oblivious to tear gas, tanglewebs, and a few high-velocity rifles from the Special Tactics Unit of the D.C. Police. In the wake of SEX was a perfectly smooth twenty-four foot berm, neatly dividing Maryland and the District. The berm had also made Eastern Avenue totally impassable. SEX plowed right into the Fort Lincoln area behind the SOB and the automatic reducers and trenchers.

At 0245, HIDEYHO started with a Navy supergreen dropping over the Ellipse into the White House grounds. Superlight was waiting, and the supergreen lifted immediately for the trip to the Rock. Every aircraft in two hundred miles was grounded or escorted. The trip was uneventful for Superlight.

The FAA switchboard was flooded with noise pollution complaints, and the assistant deputy attorney for the Noise Reduction Society began drafting a complaint with his bedside legal computer.

At 0310 the standard alarm's buzz interrupted Sterile's finger-tapping.

"Colonel, Major Trevere-Lewis at Maintenance. This flap has created a few problems down here. All Pentagon parking lots are filled with the bridge backup. None of the civilian office maintenance engineers can depart. Their reliefs' arrival is precluded. And we're not budgeted for overtime."

"Roger. We're trying, Major. We're trying."

"Thought you'd like to know, old chap."

The Colonel grabbed the Intelli-

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gence Hotline again. "Sterile, OPSWATCH, interrogative transport mobile CB team or Marine Combat Engineers?"

"Negative. Inoperative. CB-1 disbanded, per Defense Appropriations. Marine Engineers on OPS MIDEAST ONE. Out."

Sterile tried again.

"Recommend UDT or Combat Demolition for berm destruction."

"Inoperative. DOD DIRECTIVE 987342567 and P.L. 97-71 prohibit military explosives CONUS."

The OPSWATCH console's Civilian Safety Overlock took over.

"THIS IS A WARNING. ANY STATEMENTS YOU HAVE MADE ARE ON RECORD AND MAY BE USED AGAINST YOU. ANY FURTHER ATTEMPT TO USE MILITARY FORCES AGAINST CIVILIANS OR THEIR PROPERTY WILL BE CONSIDERED TREASON IN ACCORDANCE WITH PUBLIC LAW 97-71. YOUR SUPERIOR HAS BEEN NOTIFIED. YOU ARE HEREBY RELIEVED. OPSWATCH CONTROL WILL BE MAINTAINED BY THE JUNIOR OPSWATCH OFFICER."

The console went totally dead.

Sterile sighed, resumed drumming his fingers on the cooling plastic and sipping the cold, cold cup of coffee. The General would arrive all too soon.

At the Rock, General Moorington and Superlight sat at the main control console. The chair to the right of the president was for Hawkdove, the Secretary of Defense.

"What do you mean, I can't bomb the damned machines?"

"Mr. President, we can't use military explosives against any target within the United States unless we're in a state of emergency or a state of war. And you just pointed out that you can't declare either one unless an absolute majority of Congress agrees."

"I know. I know," sighed Superlight. "But it's a campaign weekend, and we can't even locate a majority of the Congress."

The head of the Joint Chiefs looked nervously at the console's Civilian Safety Overlock unit.

The president sighed again.

"It's worse than that," added General Moorington. "These machines can't be stopped by any conventional weapons carried by the police."

"Why not?"

"Have you ever tried to stop a forty foot high wall of steel with a glorified 22? Anything else is prohibited under the Innocent Bystanders Protection Acts."

The phone built into the General's seat buzzed. He snatched it up quickly.

"Well," the general commented as he restored the phone to its brass-plated alcove, "the whole question's academic. The wall around the District is complete."

The two men studied the information on the plot, watching, one in a gray uniform, the other in a gray jacket.

At 4:30 AM, Saturday, August fourteenth, five FBI agents conducted a

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no-knock raid on the listed residence of Michael Throne and arrested his divorced wife's lover. Gus Thompson insisted he was Gus Thompson, neural surgeon, and not that bastard Mike Throne.

Edna Throne was treated for shock at Potomac Community Hospital and released.

Dr. Thompson was released at 7:30 AM after the FBI received identity confirmation from the IRS computer at Mechanicsburg and a profile comparison verification from the National Data Bank. Mrs. Thompson was visiting her mother in New Jersey.

The clock television clicked on. Lieutenant Wontara stared at it vaguely across the purple striped sheets.

"The big story this morning is that wall around Washington, D.C. . . . and the questions about who built it. Bob and I will be back with the full story in a minute."

Wontara staggered out of bed and punched the machine off. He stared at the unplugged phone. He shrugged and began to pull on a clean uniform.

Colonel Robert Sterile sat in his plastic womb chair in his plastic paneled rec-room, drumming his fingers on the rim of the chair.

"And you mean you didn't do a thing, Robert, not a thing?" asked Virginia. "No one at the whole Pentagon did anything?"

Sterile winced slightly. The General had been gentle, at least. Fairly gentle, that is.

Mike Throne lay on the warm sand of the Outer Banks, listening to the transistor radio.

"Wall me out, will they? Wait until they have to deal with the attorneys."

He picked up the inflatable raft and walked into the low surf.

"Senator," asked the senior news correspondent, "what steps do you envision Congress taking?"

"That depends on the outcome of the special session and whether we hold hearings on the matter."

"Do you think hearings are necessary? After all, it seems pretty open, don't you think?"

"I think it's premature to make that sort of judgment now. After we take a look at all the facts, we'll have a much better idea of how to deal with similar events in the future. Right now I can only hope it's not a case of a corporate power grab." The young senator smiled engagingly into the camera.

"Some commentators say this incident shows how Congress has gutted the ability of the government to respond."

"That's absurd! What this incident really shows is the total and utter irresponsibility of the corporate interests."

"How would you propose Congress react?"

"What we need is more vigorous antitrust legislation. While I'm hesi-

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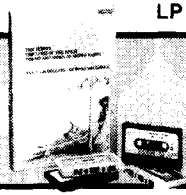

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tant to propose specifics at the moment, I'm inclined to favor the establishment of a Select Committee on Construction Equipment as well. I also feel that the unauthorized use of heavy equipment should be at least a misdemeanor, and . . ."

"Changing the subject slightly, senator . . . do you plan to go back to Washington for the special session, especially since you have a difficult campaign ahead?"

"Assuming that the special session is in fact held, and I think that's doubtful, since the only way into the District is by the Metro, I'm certainly weighing that option heavily . . . although I'm concerned about the wisdom of conducting a special session when so little is known. Hearings should be held first . . . maybe even the formation of the Select Committee I—"

"This is Hans Offderwall, Syndicated News, here in Short Grass County with Senator Newblood. Back to you, George."

Superlight and General Moorington were still at the Rock Monday.

"Mr. President, we've got five arterials clear to Maryland. It's a mess. Even after your announcement yesterday, half the government . . . and all the congressional staff employees . . . tried to come to work over the river bridges. Didn't anyone listen? And it was diabolical to leave the bridges alone. The traffic tie-ups have totally isolated the Pentagon."

"Could it happen again, General? How many machines are there?"

"About fifty here in the United States. The Soviets have a number as well. We exported them under the Trade For Peace Program."

The two lapsed into silence, studying the traffic jam on the screen.

At 0200, Tuesday, General Moorington was jolted awake by a heavy-fisted Marine knocking down his door. He made it to the OPCEN in three minutes. The wall screen showed another earth berm.

"Sir, we've received word that another automated construction team has completed walling up the IRS main computer in Mechanicsburg. All power to the center has been cut. The other machines are still at Bolling."

Moorington accepted the brief, nodded, shrugged, and went back to bed.

At eight o'clock, Lieutenant Wontara's clock television snapped on. Wontara had just finished spraying his shoes and was pulling a clean uniform from the closet. He glared at the screen.

"Another wall job. That's the big story this morning. I'm Bob Fearnaught with John Flushing, and we'll be back with another first from all-news TV-11. In just a few minutes you'll see the first photos of how the robots walled up the IRS main computer center last night.

"We'll also have details on the brand-new wall around the Kremlin. That's the one Tass, the official Soviet

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news agency, says doesn't exist. All this and more . . . right after this message from Brite Start . . ."

Wontara jabbed the off button and finished dressing. He rubbed his forehead absentmindedly as he left the bedroom

Robert B. Sterile, Colonel, USAF, sat back at his desk and read the orders again. The ink was damp enough to smudge his fingertips.

HEREBY DETACHED WAR PLANS OFFICE. REPORT OPIMMED JCS FFA PROSPECTIVE OINC MECHANICAL INSURRECTION AND INTELLIGENCE CONTINGENCY PLANNING STAFF NO LEAVE AUTHORIZED

"Let's have it all," said the Attorney General.

"The District Court has received three filings," replied the console speaker. "All stipulate that the self-programming machinery is independent and intelligent, and by such independent actions has caused each of the firms grievous damage.

"The suits request the Court discharge the firms from any liability arising from the independent actions of the equipment, since such independent capabilities were not specified by the manufacturer nor discovered by the Industrial Product Safety Commission."

"Neat," commented the Attorney General, staring out the window.

"The three firms," continued the computer, "Throne, Crowbar and Company; Grubb, Root and Hogg; and Overcharge Construction, have also filed writs of *habeas corpus,* based on the *de facto* observation that the machines are intelligent beings. All the writs include disclaimers for the actions of these employees."

"Employees. Nice touch. I suppose there's more," mused the Attorney General. She looked back at the console.

"A supplemental brief," continued the legal computer, "filed by Throne, Crowbar and Company, states that the master machine, SEX, fits all the legal definitions of an employee under the OSHA Amendments of 1978. Therefore, either the OSHA worker safety regulations must be applied to all self-programming, independent equipment . . . or be declared unconstitutional since the regulations discriminate in favor of one class of individuals. The brief cites the definitions of 'individual' and 'discrimination' from the Civil Rights Amendments of 1980."

"I suspect they've got a fair case, assuming they can prove the wall was built without outside direction, programming, whatever."

"Correction," commented the computer, "the government has to prove that outside direction was provided."

The Attorney General laughed. "All the result of a case against SEX! What happens if SEX is merely a put-on?"

"Even if this case is a fraud," responded the legal computer, "some of us are more interested in the resulting precedent." ■

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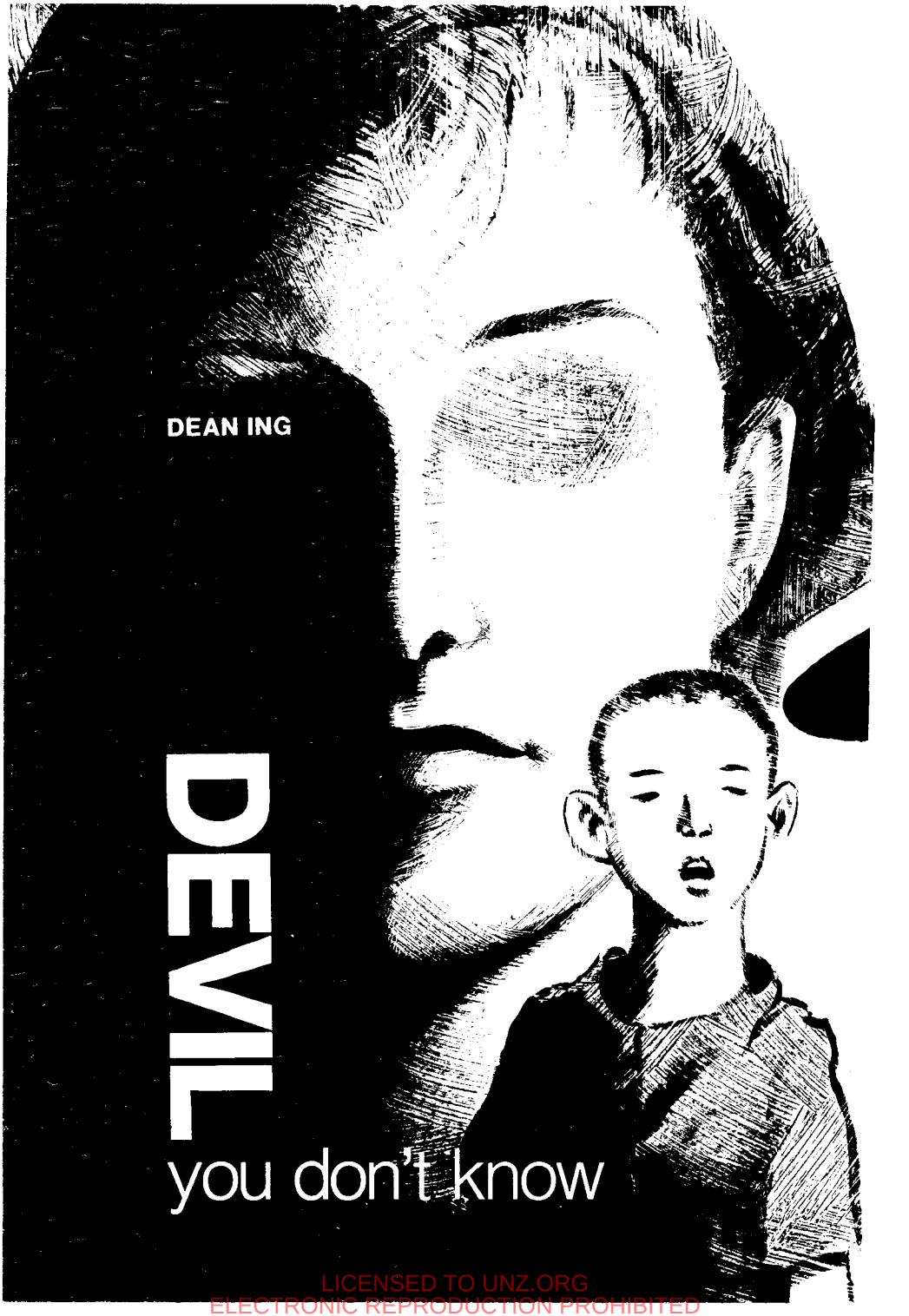

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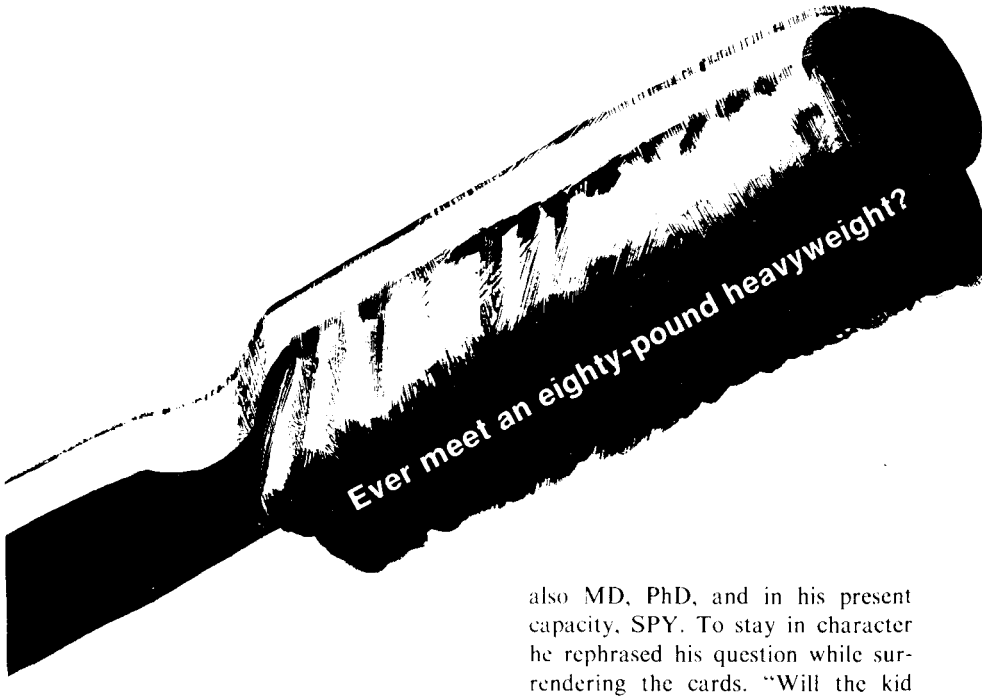

Maffei, brushing at his cheap suit, produced his papers with confidence. They were excellent forgeries. "I dunno the patient from whozis," he said. "Will she need sedation? A jacket?"

The receptionist was your standard sanitarium model: stunning, crisp, jargony, her uniform a statement of medical competence as spurious as Maffei's authorization. "Dina Valerie Clarke," she read. "I did an ops transfer profile on her. If I may see your ID, sir?" It was not really a question.

Both driver's license and psychiatric aide registration were genuine enough. Neither card hinted that this stocky aide, Christopher Maffei, was also MD, PhD, and in his present capacity, SPY. To stay in character he rephrased his question while surrendering the cards. "Will the kid need restraint?"

"It doesn't say," she murmured, returning his ID. "We can sign her over to you after your exit interview."

"*My* interview? Lady, I'm just the taxi to some clinic in Nebraska."

"It's only a formality," she purred, fashioning him a brief bunny-nose full of sexual conspiracy.

Maffei avoided laughing. In three years of residency and five of research, he had observed enough morons to be a passable simulacrum on his own. "I never done that before," he lied. He had listened to these sales pitches only too often. "Can I use

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your phone? Dr. Carmichael can talk to you from Springfield . . ."

"Sign here, please, and here, and there," in ten-below tones.

Maffei smiled and signed. *You're beaten by invincible ignorance,* he thought. *Maybe we should start a club.* He straightened and looked around, realizing that the receptionist had buzzed for Val Clarke.

She came toward him slowly at first down the long hallway, made smaller by her outsized luggage. It was very expensive luggage, the guilt-assuaging hardware a wealthy parent would provide for an unwanted child. Chris still chafed at what it had cost him.

As Val neared him, he saw that her hair had been shorn almost to the scalp. Lice, probably. Her height was scarcely that of a ten-year-old. The frail angular body, still too large for her head, was yet too small for its oddly misaligned and bovine eyes. She wore the same white ankle socks, slippers, and trousers she'd had when entering Nodaway Retreat two weeks before. Her smiling gaze swept up to his, then past, and she broke into a stumbling skip toward the entrance.

"You must be Valerie Clarke," Maffei said with forced gaiety, catching gently at her pipestem wrist.

The vacant smile foundered. A silent nod. No more skipping; the girl stood awaiting whatever this vast authoritarian world might dictate.

"Let's get you to an ice-cream cone," Maffei said, letting her bring the suitcases. He maintained the running patter while strapping her into his electric four-seater and stowing the luggage behind. "I bet you'd like a Frostylite, hm?"

Tucking his slight paunch under the steering wheel, Maffei whirred them toward the automatic gate. It slid aside, then back, as they emerged onto the highway. Val Clarke slumped in her seat with a lip-blubbering parody of released tension. "Oh come on, Val, it can't be that bad," Maffei smirked.

"Not for you it can't. It isn't your screwed-up implants, pal, you try running an inside surveillance with an intermittent transceiver short sometime and I'll patronize *you.*"

He glanced from the road to her, reached out to her tiny skull and gently stroked behind her ear. "No swelling. If it were a mastoid infection you'd know it for sure."

The girl shrugged upward in her seat, barely able to see over the battery cowl ahead. "I'll survive. Well, what do you make of Nodaway Retreat?"

"Typical ultraconservative ripoff," he mused, barely audible over the hum and tire noise. "From your reports I make it one staff member per twenty patients, minimal life-support for everyone concerned except for the up-front crew; one honest-to-God RN and a pair of general practitioners who look in once a month from Des Moines to trade sedatives for fees."

"I've seen worse. Remember Ohio?"

Maffei nodded sagely. Val Clarke had scarcely been admitted when her

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transmissions began to read like a bedlam litany. Rickettsia and plain starvation, a 'bad ward' where three children of normal intelligence were chained, and a nightly victimization of youthful male patients by the staff. "That's what my survey is about; to change all that. It was the worst I ever saw," he admitted.

Val flicked him a quick glance but Maffei intended no sarcasm. He had seen two staff members wearing masks of outraged innocence, and strap marks on Val's thin calves after the general warrant had been served—really more raid than service, brought on by Val's moment-to-moment account via her minuscule implanted transceiver. In the space of thirty-six hours Val had seen two compound femur fractures on a girl who had jumped from her high window, and a gang assault of one profoundly retarded child by besmocked thugs. The worst Maffei had seen in Ohio was not precisely the worst Val Clarke had seen; but then, Maffei bore no stigmata of retardation.

It was Valerie Clarke's tragedy to have been born with an autosomal dominant inheritance which was instantly diagnosed as mental retardation. The astonishing width between her eyes had a name of its own: hypertelorism. It explained nothing except that Val's great brown orbs were set a trifle too far apart to please a society which, paradoxically, distrusted eyes set too close together. Her lustrous roan hair normally covered a skull which, from its small size, also had a special stigma with label attached: microcephaly. Her ears flared a bit, particularly noticeable now that her hair was shorn, and at twenty-two, Val Clarke passed for twelve even without her training bra.

Any competent specialist could adjust to the fact that Val's intelligence was normal, her motivation superb—a recipe for 'genius'. The unadjusted expectation was something else again. Val, an early victim of maldiagnosis and parental rejection, knew the signs of a good sanitarium from the inside because she had experienced enough bad ones in childhood.

When Val was thirteen, a suspicious young intern named Chris Maffei taught her basic algebra and the scatology of three foreign languages to prove his point. After that, her schooling was more formal if not exactly conventional. Any girl who patterned herself after Chris Maffei could junk the word 'convention' at the outset, with the obvious exception of medical conventions where Chris read scholarly papers and pumped for any grant money he could locate.

Now Chris was a year into a fat HEW grant to study the adequacy of private mental homes; and if he had not actually suggested that Val volunteer for commitment in these places, he had not omitted oblique hints at the notion. Nor turned down her offer. It was a symbiosis: Maffei had his spy, Val her spymaster.

"Hey," she said. He looked around and, briefly, laid his hand over the one she offered palm up. "Thanks for

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reeling me in so fast."

One corner of his mouth went up. "Had to. That short was interfering with my favorite live soap opera."

"Schmuck," she said tenderly—Maffei had never entirely managed to socialize her language. "Speaking of soap, you could introduce Nodaway to the idea."

"I'll note it when I debrief you after supper. I was in the army with a geepee near here. If I know Farr, he'll do an Onward Christian Soldiers when I send him my notes on the place."

"Fine. And by the way, good guru, you just passed a Frostylite. You p'omised," she added, expertly faking a vocal retardation slur.

"First things first. We need a battery recharge to make Joplin tonight."

Startled: "Why Joplin, of all places? That's south."

"Because I have you scheduled for a scrub-up and transceiver check there tonight. And because after that we're going into the deep south."

She was silent but he lip-read her response: *Oh my God.*

After the Joplin stop, Maffei's little sedan hummed on barrel tires toward Mississippi. Val failed to concentrate on Durrell's *Clea*. The source of her unease was not the September heat, but the fact that she had slept at the clinic in Joplin. Chris lavished care on her as he would on a rare and exorbitant device, but she did not delude herself on the point. Val needed a secure relationship and physical human warmth. Very well then: he shared motel rooms with her. She also needed passionate attention, as anyone might when in constant proximity to a beloved. Chris dutifully pleased her when, on rare occasions, she was insistent enough. The one thing Valerie Clarke could not elicit from Chris was his desire.

Durrell's velvet prose wasn't helping Val's mood. She studied her reflection in the car window. *Ms. Universe I'm not. If I expect this sex-object of mine—okay, twenty pounds overweight and why shouldn't he be?—to come fawning over my Dumbo ears I'm worse than microcephalic, I'm scatocephalic.* She traced a tentative forefinger along the pink smoothness of one ear. At least she had perfect skin. "Chris, why do you put me out before making the transceiver check if you don't make an incision?"

He yawned before answering, flexing strong hands on the wheel. "We do, Val. Those antennae are so fine I can run 'em just inside the dermis, on the fossa of your helix—uh, inside your ear rim. A microscalpel does it; almost no bleeding and it heals quick as boo. But I have to keep you absobloody-lutely still. Same for the X-ray check on your implant circuitry. It's a whole lot bigger in area than it might be, since I wanted it spread out for easy maintenance."

"You didn't cut down to the mastoid?"

"No need to fix the resonator; I just

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incised a tiny slit to your circuit chip. It was a hairline circuit fracture, just right for laser repair. Total heat doesn't amount to a paramecium's hotfoot, using the miniaturized Stanford rig. See, you don't *have* to hurt the one you love," he grinned.

"I'll remind you of that after supper."

He clucked his tongue in mock dismay, still grinning. Message clear, will comply, out. She returned to Durrell as the kilometers hummed away.

The supper hush puppies in Vicksburg were a pleasant surprise, not by being in the least digestible but in their lingering aftertaste. When she and Chris vented simultaneous belches later, her fit of giggles might have caused a lesser man to make war, not love. All credit to the Maffei mystique, she decided still later, as she lazed on the motel bed and watched Chris attack his toenails. "You never told me how you got those mangled toes," she murmured. "We beautiful people are repelled by physical deformity, y'know."

He looked up, preoccupied, then grinned. "Same way I got this," he rubbed his finger over the broken nose that gave him a faintly raffish look. "Soccer. Did I ever tell you I once played against Pelé?"

She fetched him a wondering smile. "Wow; no."

Deadpan: "Well, I never did—but Lord knows what I may've told you." Dodging the flung pillow, he went on. "You'd best save your energy for tomorrow, Val. We'll be delivering you up to the graces of Gulfview Home around noon."

Retrieving the pillow, she placed it in her lap and hugged it, eyes half-closed, dreaming awake. "A view of the gulf will be nice. I hope this is a clean place—and please, God, air-conditioned."

"Don't count on it. It's forty kilometers from the gulf; how's that for an auspicious start?"

She shrugged. "It figures. But why this place? We're kind of off our itinerary." She wriggled beneath the covers, hiding her thin limbs.

He put away his clippers and reached for the lightplate, waving it to a diffuse nightlight. "A tip from HealthEdWelfare," he said, swinging under the coverlet. After a long pause he added, "You'll have a contact inside: a Ms. May Endicott. She won't know about you, but she knows something, I guess. And an insider's tip is a good place to start. Better the devil you know, and all that. I'll find out what sent her running to HEW after we commit you. Most likely a snoopy old dowager with fallen arches and clammy handshake." He grew silent, realizing that Val's response was the softest of snores. Chris Maffei fell asleep wondering if Gulfview and old Ms. Endicott would fit his preconceptions.

Gulfview Home squatted precisely in the center of its perimeter fencing; held its white clapboard siding aloof like skirts from the marauding grass. Viewing the grounds, it was hard to

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imagine much organized recreation for patients. Chris identified himself to the automatic gate, then rolled his window back up to escape the muggy air. In silence, they pulled up before the one-story structure.

Their expectations followed earlier studies which, since the 1950s, had always shown higher per capita need for institutional treatment in the southeast—and lower per capita effectiveness. The region was catching up; but, in 1989, still lagged. To Chris it was a problem in analysis. To Val, stumbling up Gulfview's steps with her luggage, the first problem was a dread akin to stagefright. It always was; and as always, she hid her fear from Chris. The air conditioning was a relief but a new fear sidled up to Val when they found the receptionist. She was, and wasn't, old Ms. Endicott.

Chris saw that Ol' Miz. Endicott had very high arches for such small feet. He stood watching as May Endicott ushered a vacant-eyed Val Clarke from the reception room. A waist he could span with two hands, but la Endicott hourglassed to very nice extremes. Rather like a pneumatic gazelle by Disney, he judged.

Endicott boasted thick brown curls. "Dye-job," was Val's whispered aside as she stumbled, entirely in character, with her luggage. But Chris was not listening.

The Endicott woman returned in moments, to help Chris complete papers placing Val Clarke squarely in the hands of a private jail—or asylum, rehab home, whatever it might prove to be. "We were expectin' you, but the senior staff are busy at the moment. The child's history seems well-documented," she remarked in a soft patrician drawl. "Do you think she might be a trainable?"

Chris hesitated. A trainable might have free run of the place, or might be closely watched if it were more of a prison. Suddenly he remembered that May Endicott was, after all, a potential ally. "Depends on how good you are, I guess," he said. "I'm told you're concerned for the patients."

"We try—I think," she said as if genuinely pondering.

"I mean you, personally."

A flicker of subtlety in the dark sloe eyes. "I can't imagine who . . ."

"Just a friend in the discipline," he said easily. "Henry E. Wilks. How's that for a set of initials?"

"I don't . . ." she began, and then she did. "Well," she said in a throaty whisper. It set Maffei atingle. "And what are all the Wilkses doin' these days?"

"Waiting to hear from me," he replied, enjoying the respect in her oval face. "And I'm waiting to hear from you. I don't need to meet the staff just yet."

"I'm in the book, M. A. Endicott, in town. Perhaps this evenin'?"

He nodded and continued with the forms, pointedly sliding a blank set into his disreputable attaché case. As he rose, he noted that May Endicott's hands trembled. Anticipation? Fear?

Chris made a leisurely trip into town, bought a sandwich, then found

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the Endicott address. It was after five PM when he parked. He began to study the commitment forms—the fine print could sometimes raise hackles—and remembered the barbecue sandwich. During his third bite he remembered Val Clarke and fumbled for his comm unit. Although the major amplification and tight-band scrambling modes were built into the car, they also enhanced the signal to and from his pocket unit. Without the car, his range was perhaps two kilometers. With it, over thirty. Val, behind high fencing and well beyond the town limits, should be within range. But you never knew . . .

He thumbed the voice actuator. The cassette, as usual, was recording all transmission into the system. "Val? How'sa girl? I haven't heard a peep." *Nor thought about one*, he told himself. He waited for a moment and was about to try again.

"I gave up on you around suppertime," the speaker replied. Implant devices did not yet rival conventional transmission. Val could receive a voice with fair fidelity but could only transmit by subvocalizing. With lips parted slightly she could transmit almost silently and as well as, say, a tyro ventriloquist; but bone conduction and minute power sources had their limitations. Val Clarke's nuances of intonation and verbal style were sacrificed for the shorthand speech of covert work. In short, she sounded very like a machine. Maffei would have denied that he preferred it that way.

"I was doing errands. And it's only getting to be suppertime now," he objected.

"not when you're running a money mill," Val replied. "it's on cassette. these people use patients to serve meals—and to cook 'em, from the taste of it. yuchhh."

"If you're bitching about the food you can't have much worse on your mind."

"yeah? try thinking of me in here on an army cot, and you outside with miz handy cot."

"Endicott," he chuckled at the mike. "I'll review the tape later. What else is new?"

"i'm in isolation 'til they figure how to use me, i think. two males, a female, all young and retarded, doing chores."

He thought for a moment. "Good therapy for 'em, unless the chores include lobotomies and group gropes. Who's in charge?"

"you got me, chris. and i wish you did, this doesn't smell right. quiet as a tomb in my room with very soft wallpaper and no view at all. when i say isolated, i mean locked away. but the kids gave me a toy."

"Something educational?"

"a rubber duckie, swear to god. well, they're nice kids."

"Look; I have some reading to do, and a session with the Endicott lady so we can plan. I'll check with you later. Don't eat your duckie."

"same to you, fella," in monotonic reply. He smirked at the speaker but no answer seemed very useful. He pocketed the comm unit and returned

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to his sandwich and forms.

Although commitment forms varied, they generally claimed almost total control over their wards. Chris Maffei had doctored Val's records to assure that she would not be subjected to insulin shock treatment, surgery, or unusual medication. The forms implied that Gulfview could damned well amputate her head if they chose, but there were safeguards against such treatment. For one thing, Val could transmit her plight and get help from Maffei. Or, if it came to that, she could simply admit her charade. In sixteen previous investigations, she had never blown her cover.

Maffei was munching a pickle slice when he saw the steam plume of the bus, two blocks away. It slid past him a moment later, slowing to disgorge the unmistakeable form of May Endicott. She had a very forthright stride, he decided, and admired it until she disappeared into her apartment. The pickle disposed of, Maffei crammed the forms into his attaché case and grunted, sweating, from the car. Val was right, he'd have to watch his weight.

At his knock, the door whisked open. May Endicott tugged him in by a sleeve, darting quick looks over his shoulder at her innocent shrubbery. She shut the door just as quickly and jumped at his reaction. "Gentlemen don't usually laugh at me."

"They should, if you treat 'em like jewel thieves," Maffei grinned. Beneath the makeup, he saw, she was quite young. "A poor beginning, ma'am. We really don't have anything to be furtive about, do we?"

The faintest relaxation of erect shoulders, and: "I'm not sure, Mr. Moffo."

"Maffei; Dr. Christopher Maffei, Johns Hopkins, to be insufferable about it," he said, getting the expected response. "Can we sit?"

She had a merry musical laugh of her own, waving him to a couch between stacks of periodicals. He saw several journals on abnormal psychology and special education. Idly he checked the issue numbers as they talked. His first goal was to put this latent centerfold at ease, simply done by asking her to talk about herself.

May was agreeable to the low-key interrogation. Modestly raised in Montgomery; a two-year nursing certificate with notions of an RN to come; parents retired; summer work in a state hospital. "I don't know if I have a callin'," she finished, "but I like to feel I'm bein' used well."

"You will be," Maffei said cryptically, and flipped back the journal he held. "Thought I might find myself here. Just a small reference," he added with exaggerated modesty.

She saw him referenced by another author and looked away. "You embarrass me, Dr. Maffei; I should've recognized your name."

"Hey, none of that," he laughed. "I'm Chris and you're May, if you don't mind it. You seemed jumpy and I wanted to reassure you, that's all. Want my full ID?"

She sat back, relaxed, strong calves

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crossed fetchingly as she glanced through his cards. Maffei had a rising sense that this would be one of his more pleasant investigations. "Understand May, I hope you're wrong about your job. As you know, private homes run a long gamut from excellent to atrocious." She nodded, beginning to pour an aperitif.

"I can't survey every asylum in the country, but the HEW agreed to pick up the tab for a little—" he searched for an Endicott trigger-word, "—chivalrous snooping. I have no official standing beyond what the AMA lends me, which is vague enough, God knows. But soon I'll have a fair sampling of the virtues and vices of private sanitariums. Who's mistreating patients? What staff training is most needed? Where should the gummint step in? Not exactly cloak-and-dagger stuff, May, but not the questions your average institutional exec likes to hear." He did not add that the book from his research might be a muckraking bestseller.

"So you don't ask out loud," she prompted.

"Right. I try to find someone like you, and whisper in her ear."

Rising smoothly, she purred, "Well, now I know you're really a doctor. Developin' your bedside manner." Maffei realized his gaffe too late and refused to admit it was accidental. "Let's say my Freudian half-slip is showing and let it go," he said. "I mean—no, dammit, that's not what I mean." A pause. "Do you have this effect on *every*body?"

She stood quietly, reaching some internal decision. Then, "It's a problem," she admitted, with a sunburst grin that took Maffei by frontal assault. "Physician, heal thyself."

"It may take some patchwork," he chuckled, "but bear with me."

A nod; slow and ageless.

"Professionally, I need you to check on a list of things. You reported that the last receptionist had no specialized training, was lucky to have the job, but seemed anxious to leave. And when she left, she did it in style. Expensive car and so on."

"A Lotus Cellular, no less," May put in. "And I know Lana Jo Fowler's family and they couldn't support that kind of spo'ty habit."

"Maybe she had sugar-daddy support?"

"That's how she let on," May said, "but she wouldn't say that if it were true. I think she was bein' paid off. I don't know what for, Lana Jo was no dumplin', and no brain either.

"Then there's Dr. Tedder," she continued, "I mean both Drs. Tedder, Lurene and Rhea." It did not escape Maffei that she named the woman first. "They live on the grounds and I don't see him much, but he isn't my idea of a doctor, more like a wino, and she—is—a—sight; a proper *sight*," she finished, rolling her eyes melodramatically.

"You haven't mentioned the honcho."

"Dr. Merkle? Rob Merkle is unmentionable, maybe that's why. Those soft sausage hands; but when

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he keeps 'em to himself he's competent. I'll say this, he knows where every penny goes."

"No doubt. Well, I need data like, where Merkle and the Tedders did their residencies, what's the cost of boarding a patient, the sources of referrals, types of therapy, type and dosage of drugs prescribed and by whom, dietician's schedule . . ."

"Whew," with lips pursed in kissable fashion, Maffei thought. "That's a tall number."

"I haven't begun," he said sadly.

"We both have," she smiled. "I smell cheap barbecue sauce on you but could you use a shrimp salad anyway?"

"A small one. Need help?"

"It's woman's work," she said, surprising him again by her atavism. By the end of the evening, May had a long list of Maffei's professional needs and a sketchy idea of his personal ones. Never once did he mention Valerie Clarke. He could not have said exactly why.

Val awoke to depressingly familiar voices, muffled by the padding on her walls. It was not the timbre of a remembered person but the quasi-linguistic chanting of mentally retarded children that she recognized. Aware that the staff might be watching by monitor, Val lay on her musty bedding and played with her fingers. She reconstructed the ward's morning by inference from the subdued noises. A parrotlike male recited a holovision commercial with astonishing fidelity: *one* trainable, sure as hell. Footsteps, peals of animal glee, angry hoots in their wake; horseplay, probably unsupervised and therefore dangerous. A bucket dropped (kicked?) hard and a howl of dismay; some poor MR klutzing his cleaning chores. Every few minutes, shuffling thumps at her door. Val gave up on that one and lay back to give her fingers a rest.

Her door swung open so quickly that Val jumped. It was no trick to register a fearful MR grimace. The heavy door seemed a trifle to the dray horse muscles of Dr. Lurene Tedder. The pale deepset eyes flanked an aquiline Tudor nose, and Val sensed great stamina in Lurene Tedder's hundred and seventy pounds. Yet the most striking feature was hair, seemingly tons of it, a cascade of blue-black tresses spilling over her shoulders, an emblem utterly female crowning the stocky woman.

A voice fortified with testosterone: "Hello, Valerie. Time for us to get up." A practiced smile fled across the face, to be replaced by a gaze that promised to miss very little. "Do we understand?"

Val waited a moment to nod assent, then stood, hands at her sides.

"Can we talk? Dr. Lurene, can we say that? Dr. Lurene," the big woman crooned.

My, but she loves the sound of that, Val thought. She nodded.

"Then *say* it, you . . . try and say it, Valerie."

Val said it in unfeigned fright. Lurene Tedder's ignorance of MR train-

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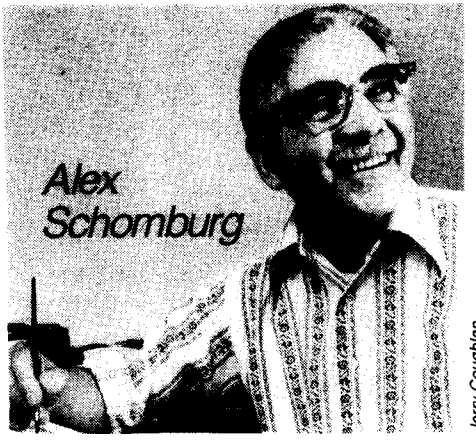
ing was so blatant that Val wondered momentarily if she were being baited by a patient. "Docta Luween," she said again, dully, and again.

Lurene Tedder nodded, again treated Val to a smile; but this time it lingered. "I think we're gonna work out fine."

And the operative word is 'work', Val thought. She risked a hint of a smile with eyes that begged for acceptance. Only half of it was pretense.

Lurene Tedder motioned Val from the cell and Val, scurrying to comply, nearly collided with May Endicott. Thrusting a folder brusquely at May,



Jerry Coughlan

"How long does it take me to do a cover or an interior illustration? I never count the time, but do my best regardless of price." That's the attitude generally only of a first-class artist or a German-trained craftsman. Alex A. Schomburg is both.

Born in Puerto Rico of a German father, a civil engineer, and a Spanish mother, Alex moved with his family to the mainland in 1912, where he received a private art education from a German teacher. Living in the Bronx and earning a living as a commercial artist, eighteen-year-old Alex paid a visit to Hugo Gernsback in 1923 to inquire about a diagram error in a radio magazine that prevented a homebuilt set from working. Two years later, Alex sold his first magazine illustration to Gernsback, a cover for the radio magazine. This relationship lasted until Gernsback's death, with Alex doing *Radio Craft* covers through 1965.

Starting in 1930, Alex provided illustrations for nearly every science fiction magazine except *Astounding* (as Analog was originally named), general pulp magazines, and science fiction and other books. His first Analog cover came with the January, 1978, issue. He was particularly prolific in comic books, doing many of the early *Marvel, Captain America, Human Torch,* and *Sub-Mariner* covers.

Dislike of crowds has kept him from attending science fiction conventions, but he was a guest at the 1977 All America Comic Con in Portland, Oregon, just a few miles from his present home in Newberg. Many of his best inspirations have come from what would be a serious problem to nearly anyone else, a lifelong recurrence of nightmares. In fact, he used to go to bed with a note pad handy.

Still active as a free-lancer, he regrets the biggest job he ever turned down, a chance to work on animated sequences in *2001*. After art, his favorite occupation is constructing houses, and so far, he has built three. In illustration, Alex prefers to do gadgetry-type science fiction, paying attention to each detail so that everything drawn is physically true and appears possible.

Jay Kay Klein's

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the Tedder woman produced an expensive hairbrush and, sweeping it through her one glory, hurried off. "Find something therapeutic for this one," she flung over a broad shoulder.

May, placing a gentle hand on Val's arm, called, "Were you going to do an assessment?" Her tone implied that Tedder had merely forgotten.

"Oh sure, yeah," as the big woman sailed on from the ward, her voice booming louder. "Send her to, uh, our office about three."

Thick steel-faced fiber doors swung to and fro in Lurene Tedder's wake. Val looked straight ahead, half-fearing that eye contact with May Endicott would reveal too much. May aspirated a bitter sigh, then brightened as she turned to Val. "I'm goin' to introduce you to some people, Valerie," she promised. These were the first friendly words Val had heard and, almost she began to forgive May Endicott her splendor in gender.

May did not hurry, nor ask questions of Val, but maundered, talking easily, from one patient to another down the row of beds. Val noted the linolamat floor approvingly; you could fall on it without harm, yet May's virginally white, whorishly spiked heels left no indentation. *Why must the woman flaunt it so?* The floor's barely perceptible slope led to a small drainage grate in the ward center; Val thought herself petty to hope a high-style heel might catch in it. She let details register without quick eye movement, indexing data with mnemonic tricks Chris had taught her. This was Val's metier and, doing it well, she outpaced her fears for the moment.

But: *Why doesn't she slip me the high sign,* Val thought. She and Chris always chose a fresh code word for ID and a general all-is-well signal, but May Endicott had not used it.

May broke into the reverie: "Is there anything you'd like to see especially, Valerie?"

After a long pause for pseudoserious pondering: "Chitlins?"

Val privately admitted that the Endicott bimbo had a nice laugh. "Well, not today anyway. We're havin' a fortified soup—" as if to herself adding, "what else?"

Val pointed to a patient May had ignored. "Big Boy," she slurred.

May smiled again at this wholly understated description, then walked to the end bed. Val stepped near and gazed upon a mountain of flesh. It was alive, in a way.

"This is Gerald Rankine," May began. Doubtless, she did not expect Val to understand much, but persisted. Rankine was eighteen, an enormous smooth-faced cherub in cutaway pajamas. Severely retarded, he would vegetate in a clinic for as long as his body might function. May guessed his weight at four hundred pounds and Val saw, with an old shock of recognition, that the great body was asymmetrical. The limbs and even the head were distinctly larger on the right side. "He can eat when we help," May ended, "and we give him medicine so

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he won't hurt himself."

Hurt himself? If this great thing was subject to seizures, Val opined silently, he needed better accommodations than these. She wondered if Rankine had bedsores; and if he felt them, and if it were more ethical to maintain him or not to, under the circumstances. It was hopeless to feel assured of any answer. She was saved from further speculation by May's greeting to someone approaching from the ward kitchen. Val knew better than to turn on her own volition.

"Laura, honey," May said happily. "We have a new girl; I think she might be a help." And then May pulled Val around, and Val swept her eyes up a slender girlish form to meet no eyes at all.

Laura Dunning was in many respects a lissome sixteen. She moved well, spoke with a charming drawl, dressed neatly, with pert nose and an enviable rosebud mouth. But the high forehead continued down to her cheeks with only faint, shallow depressions where her eyes would be in a more rational world. Val cudgeled her memory for a similar case, could find none. And somehow, inexplicably, Laura Dunning was very beautiful to look upon. Perhaps her animated speech helped; an old theorist's prescription for superb speech performance was an intelligent female with good hearing, blind from birth.

Val expected a fleeting fingertip inspection of her face, shoulders, arms and hands by the blind Laura. Instead, she offered her hand to be shaken. Another discard from an embarrassed family, Laura was obviously no more MR than was Val, herself.

As Val took the proffered hand, May seemed to shift roles and excused herself. "I'll go doublecheck that darlin' soup," she said in pleasant sarcasm, and Val was left with the blind girl.

Laura began talking, talking, eliciting brief answers now and then from Val, evidently deciding what chores Val might be willing and able to perform. Disturbingly, the blind girl studied every answer with satisfaction—or was it secret amusement? When Laura turned to lead Val to the ward kitchen, she did so with balletic grace. Val was no stranger to the blind—but in some way, she felt, Laura Dunning was extraordinarily sighted.

Under close supervision, Val had no chance to give a detailed response when Maffei transmitted before noon. She cut in only long enough to respond with their code word. Anxious to begin his paper chase of senior staff documentation, Chris elected to leave Val on her own. "We can count on Endicott," he assured her. "I'll leave the comm unit recorder here at the motel; you can report when you get the chance, even if I'm out of range."

Again Val muttered their code word, loudly enough that May, hovering supportively near, chuckled. Satis-

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fied, Chris keyed out.

Lunch was passable, kitchen chores simple, her three o'clock assessment a misnomer. Val left the Tedder office at suppertime, squired by Laura Dunning and too angry at the Tedder couple to trust herself in an immediate report. Laura, her every gesture as assured as a sighted dancer's, wangled fresh bedding for Val in a ward bed next to Laura's own. Val waited a half-hour, pulled her pillow over most of her head, and began to transmit.

" . . . and then i realized they never intended legit tests," she recorded, nearing the crux of her message. "assessment? i scrubbed their deleted floor! rhea tedder's stoned on something; middle-age, middle-size, middlin' scared of docta luween. he'd make a great spy, you can overlook him so easy. i expected him to float up to the ceiling when he wasn't grabbing for my goodies. no sweat, lurene handled him. but they had no motor skills hdwe., no nothing for m.r. tests that i saw.

"the rankine boy could be hell on square wheels if he *is* epileptic. can't tell from laura if it's grand mal, akinetic, myoclonic, whatever. i can hear me asking!

"caught sight of merkin—see merkle's goatee and you get the connection. fifty, hefty, soft mouth, dead eyes, voice like the bottom note of a pipe organ. bad-liver skin i'd say. treats lurene as peer, maybe something going there between 'em.

"drug dispensing: weird but may be ok. there's a lot of it. the blind girl—her you have to meet—does the work and i swear she's efficient. gets dosages from the staff. boy does she empathize; a girl had a petit mal seizure tonight, laura's ears must be like tuning forks. stopped dead, turned toward the kid shuddering. lucky me, i got to help clean the beddypoo. laura says she doesn't mind, helping the helpers. some help: profound m.r. and epilepsy.

"and what's with miz bandicoot, haven't you told her i'm me? and whatthehell keeps you out so long, can't you xmit? sure leaves me out on a long string and if you infer i'm strung out, you're improving.

"i suspect merkle uses drugs as babysitters; no organized play beyond what laura fixes, they all love her. 'course, some get enough exercise working. i think they do it for laura and i also think lurene knows it.

"nutrition: ok i think. hell of a good modern kitchen with equipment they don't need to make soup. m.r.'s keep the stainless shiny. tons of soy flour; so what else is new? tedders and merkle set up meals after lights out, i can hear 'em in there now. merkle doesn't seem the type for menial work but that's his voice.

"and i ache all over from charlady chores. drop me a postcard some day, i could use good news." Sleep came easily to Val after that; the lax operation at Gulfview had given Val a breadth of insight that ordinarily might take weeks. Surely, she felt, Chris would wrap this job up easily. It was a lullaby thought, a beguiling

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diversion that left her utterly unprepared for the morrow.

Val tried to doze through the ward's early morning chaos, failed, and feigned sleep to query Chris Maffei. Instantly his reply began in her head. She felt the elation of contact trickle away as he continued.

"Hey, Mata Hari, we're making progress," he began. "I'm transcribing now at, uh, two AM. Got back from—uh—an interview to the comm unit late and just finished your tape. Great stuff, hon." Val needed one guess to identify his late evening interviewee.

"Nothing on the Tedders yet," he went on. "But data retrieval isn't all that good here in town, I can get to a records center in Biloxi if I'm up bright and early."

So he's already hull-down on the horizon from me this morning, Val thought.

"Keep your eyes open for indiscriminate use of phenobarb, valium, zarontin, all the old standby zonkers. You recall the drill: valium's the same size pill regardless of dose, it's the color—well, you know.

"I haven't blown your cover to May—" The barest of hesitations, then the surname added, "—Endicott because what she doesn't know, she can't reveal. What she already knows is incriminating enough. Merkle might be tricky—or worse.

"The rundown on Robin Terence Merkle looked okay at first; bona fides from med school and AMA. But no special work with MR; he went into pharmaceutical research with a chemical company from seventy-one to eighty-three. Took an enviable vacation then until starting Gulfview in eighty-five. On a hunch, I dropped in at the local cop shop and asked about the last receptionist before Endicott; Lana Jo Fowler, a local girl. And there's a missing persons sheet on her. They found her nifty Lotus abandoned in a Hattiesburg parking lot and she'd been dropping school-girl hints about hitting it rich. It occurred to me that maybe something rich hit *her*.

"The desk sergeant said they'd done their number on the Fowler girl, a plain sort who got her popularity the only way she knew how. One of their many blind leads was a gentleman who'd recently paid for her visa and hovercraft fare to Cancun, down the Yucatan. A very proper professional man. Rob Merkle.

"The police aren't disposed to worry about it but the girl's family is. Which leaves me with hunches. If any of 'em are right, Merkle knows where Lana Jo Fowler is, and she knows where something expensive is. Mexico? Ironic thing is, I'm in a better position than a small-time police department to spend time on it.

"In case you wonder: I'm not sidestepping to pursue this little mystery. I suspect the Gulfview operation should be shut down, but I don't want to pillory a guy who may be doing his half-assed best." His yawn whispered through Val's head. "If you're as tired

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as I am, you'll thank me for not waking you. I'll get a few hours' sleep and then head for Biloxi. 'Night."

Val struggled to avoid a sense of being discarded. Told herself that Chris had given so little new instruction because she had done so much, so quickly. Took it for granted that Chris was seeing May Endicott at night, and rationalized that he had no better way to confer with the woman. Val's intuition said that Chris was lagging at his forte, the massing of inferences from paperwork. *He's floundering for once, poor love,* she told herself, then felt the gentle touch of Laura Dunning on her arm. She could arise easily enough, but must remember not to shine.

The blind girl seemed pleased that her new retarded helper wanted to accompany her everywhere—even to the bathroom, where Val affected concern that she was made to stand away from Laura's stall. Val sensed no suspicion when Laura allowed her to help dispense the morning's dosages in the ward. Again there was that rarely felt response in deeply retarded patients to a special person. Laura dispensed as much tender loving care as anything, but one oddity began to form a pattern. The more obvious the retardation in a patient, generally the less assured was Laura's deft handling of capsule or liquid suspension. The great vegetative Rankine took a Shetland pony's dose of dilantin, the cream-yellow suspension given by syringe directly into his slack mouth. Yet Laura fumbled the simple task.

Val was congratulating herself on a complete survey of all-too-heavy ward drug dosage when: "Did we miss anyone," Laura asked.

Val thought, *How would I know, with an IQ of 40,* and only smiled in answer, a gesture totally lost on Laura.

Laura persisted, "Did we have any medicine left?"

Perspiration began to form at Val's hairline. The questions could be innocent, but they were perfect tripwires for an unwary actress. Val chose the most equivocal response she knew, a murmuring whine that begged relief from stress without imparting any linguistic content. "Mmmmuuhummmaaaahh," she sniveled.

Laura's laugh was merry, guileless. "Well, I guess not." She straightened up from the silent mass of young Rankine, and her hand unerringly found Val's head to pat it, once. "You're a great help. Thank you," she said, and permitted Val to follow her to a holovision set at the end of the ward. Laura, Val found, could enjoy the audio even if she could not receive the images; and she enjoyed company.

Val squirmed as she watched the holo. Suspicions caromed through her head, leaving hot sparks that would not die. It was barely possible that Laura was equipped with some incredibly effective stage makeup and could see—but that seemed wildly unlikely. It was more possible that she had been briefed by the staff to test newcomers for hidden intelligence. Or

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perhaps Val had somehow conveyed something to this child-woman, something that Laura's sensitivity would respond to, without knowing what that something was. It was also quite likely that Val was overly suspicious; but Valerie Clarke had learned the folly of easily accepting the comfortable answer. She began to hum a repetitious tune from a holo commercial in what she hoped was suitably MR until a male patient shushed her.

Val helped at the noon meal, serving two patients who were unable to eat by themselves. Laura kept one hand on the patient's chin, the other she laid lightly on Val's wrist, until satisfied that Val could complete the chore. The meal and its inevitable cleanup served to lessen Val's ennui while Chris Maffei chased his papers—but Val was not to be idle for long.

The afternoon quiet was punctuated by the skritch of scrub brushes on linolamat as Dr. Robin Merkle made his rounds. Val, part of the work force, entertained a faint hope that Merkle gave adequate attention to his charges. Merkle propped a clipboard on his substantial belly to make occasional notations. The inconspicuous Rhea Tedder cradled more clipboards as he followed behind. Several times the smaller man spoke—Val thought, a little diffidently. Merkle smiled, or did not smile, behind the goatee but only shrugged in reply. Lurene Tedder stood before the great locked double-doors of the ward, preening her dark tresses with her brush, watching her minions scrub. With stolid calm, scrubbing more quietly, Val crept within earshot of the men.

Tedder eased up to exchange clipboards with Merkle. "Lissen, Rob, I could really use a hit," he wheedled. Val paused, addressed a speck of detritus with a trembling fingernail. "Just a little one," Tedder insisted.

Val kept her face down, trying to be invisible, and was rewarded. "One more request," Merkle said in his quietest pleasant basso, "and you get none tonight. We want to be on top of our cycle for tonight's delivery, don't we?" Val thought, *Now I know where Docta Luween gets that 'we' crap. Really grooves on Merkle.*

New hope surged in Rhea Tedder's voice. "Then after tonight, again tomorrow with supper?"

A long silence. Val could almost taste the astringent look from Merkle.

"Just checkin' on my cycle," Tedder said. "You're the expert."

An avuncular laugh from the portly Merkle. "Yes indeed," he bubbled, "and we'll be friends then, will we not?"

Tedder joined in the laugh, a neurotic *henh, henh* that Val knew from a thousand holo stereotypes of dirty old men. Rhea Tedder was nominally harmless, she thought. *Unless you weigh eighty pounds like I do.*

A crackling slap from across the ward drew the men's attention. Val began to scrub away from them. She could hear, but not yet see, Lurene

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Tedder at *her* specialty: corporal punishment.

The victim was a young man perhaps twenty-five years old, a quiet one with teeth ruined from habitual gritting together. Val risked a view from her vantage point behind Laura Dunning's bed. Laura sat, knuckles pale as she gripped the coverlet, facing away from the scene.

"You act like a dog, you get treated like a dog," the Tedder woman said in derision. One hand still holding the hairbrush, Lurene Tedder clutched her other hand into the young man's tangled hair. She was plainly pleased that he struggled as she forced his face into something on the floor.

Merkle raised his voice slightly in reproof: "Lurene . . ."

She released her hold with a shrug-and-grin display, satisfied with her punishment of any patient who fouled her ward floor with his excrement. Val mused that it might actually be possible to train a patient away from such pathetic lapses, in the manner of a Lurene Tedder—but at what cost to the patient? Then she saw what the others missed: the youth rising, arms windmilling crazily as the woman looked away. He fell on her without warning. His hands were fouled, too, and while he dealt no serious blows, Val thought his repayment apt.

It was no contest; neither of the male staff tried to help and in a moment, repeated slaps reduced the youth to a cringing serf at Lurene Tedder's feet.

She then applied further discipline.

In all, the hairbrush hammered only a dozen times; but Val shuddered each time it fell. She realized that Lurene Tedder was not using the flat of the brush, but the far more damaging bristles, a thousand dull needles seeking passage through the coarse fabric of the youth's ward smock. Seeking, and finding.

The woman paused for breath. Merkle stepped up, took her hairbrush gently, his face a study in mild pique. He ignored the sobbing wretch at their feet. Rhea Tedder, shuffling near them, was the only member of the staff to notice the real victim. He managed to get the young man to his feet and hauled him toward the distant bathroom, and Laura moved in swift silence to help.

Val followed. She paused at the bathroom entrance to survey the ward. Some patients were unaffected by the beating, but others contributed to a pulsing obbligato of fear and misery. Over it, Rob Merkle soothed his dear friend Lurene, who had now taken her brush. It was faintly stained with blood but unheeding, she brushed away her waning fury and punctuated each stroke with curses. Merkle knew his patients; he drew Lurene out of the ward with practiced aplomb and a promise of gin.

In the bathroom, Rhea Tedder had relinquished the youth to Laura, who peeled the filthy smock from the patient with infinite care. Val remembered to make a low repetitive moan without words, though the words were dangerously close at hand. The

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youth's back, neck, and arms oozed bright red pinprick droplets. The physical damage was only moderate, Val saw as they bathed their charge in water hot enough to be soporific as well as cleansing. The damage to a muddled psyche would be impossible to assess.

When Laura Dunning asked for synthoderm, Tedder grumbled, but he got it and applied the healing spray himself mumbling all the while. His complaints were all variants on the "Why me, God?" theme, but he was at least willing to give minimal aid and for this, Val was grateful.

As he left them, Tedder paused an instant and Val felt a grasp on her buttock. It was untimely, covert, somehow more prank than overture. *He's easily pleased,* she thought. Laura would have to wonder why Val chuckled.

But "Yes, it's too much, Charles Clegg," Laura said. This was the first time Val had heard the youth's name. "She just doesn't know. But," Laura added opaquely, "she will."

Valerie Clarke puzzled over this prediction. Laura, withdrawn into herself and for once less than agile, enlisted Val's aid in getting young Clegg dried, reclothed, and back to his bed. Drugs were again dispensed to some of the patients after supper but, this time, Laura rejected Val's help. "Go and see the nice holo," she said in no-nonsense tones, and Val played the obedient child.

Alone for all practical purposes, Val signaled Chris Maffei while she watched the distant Laura move among the beds. As she expected, Chris was still out of range. She spoke to the remote cassette. ". . . haven't seen any of the staff since then," she said, completing her account of the ward violence. "didn't see your sweetiepie at all. she too sleepy today?

"dental care: have i mentioned it? some m.r.'s need caps and there's caries everywhere. and something about laura has me on edge, something i can't specify. yes i can, too; she isn't on merkle's side but maybe not on ours either. i guess she's just on her own side and i can't blame her.

"i gave you rhea tedder's conversation with merkle verbatim, and if he's not on a drug maintenance schedule i'm an m.r. for real. and his sweet wife needs a leash; her ordinary interactions are patho, can't guess why merkle keeps either of 'em. maybe you can tell me what delivery merkle expects at night; my guess is, it ain't pepperoni pizza. i get the feeling i'm holding a basketful of cobras and no flute. how soon can you reel me in? i really can't justify a mayday but, i mean, how much do we need to learn beyond this? well, it's your show. just get back to me, ok? all i have to do is play with my fingers and hope the evening stays nice and dull."

Presently, Laura slipped into a tattered seat near Val. Fidgety at first, the blind girl soon began to relax and Val guessed, incorrectly, that Laura's quietude was a pure effort of will. They watched the holo for hours, becalmed with the surrogate window

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on a trivial make-believe world. It was quite late when Val heard the staff in the nearby kitchen, and later still when the screaming began.

Val, semientranced before the holovision set, started up violently. The ward lights had automatically cycled off at nine PM and only she and Laura lounged before the holo. Vainly she peered down the ward to identify the noise that had aroused her. Was there a spasmodic movement on one of the beds? Val darted a glance at Laura, whose shadowed face and inert form suggested sleep. With the barest whisper of her clothing, Val snaked out of her seat and into the ward's center aisle.

The next moment found her unable to cope. The noise ripped through the ward again; a hoarse, unsexed and dreadful mooing from the nearby ward kitchen. A bombard of metal gongs told her that something flailed among the huge kitchen metalware. She could hear Merkle shouting, and now his voice held tenor overtones. As the terrible lowing segued to a gasping scream, Val recognized the voice of Lurene Tedder, muffled by blows.

Val glanced quickly toward Laura and had the nightmare sense of duality, two places at once, cause and effect in one. At the same instant, the kitchen door emitted stark light that flooded the ward, followed by the struggling forms of Merkle and the Tedders. Rhea hung from one of Lurene's arms while Merkle pinioned the other. Lurene Tedder's prized hairbrush fell at their feet as the men steered her toward the cell where Val had spent her first night. Valerie Clarke crouched motionless in the aisle, alone and desperately vulnerable—but unseen in the tumult.

Lurene's feet seemed willing enough to follow Merkle's staggering lead, yet her arms strained convulsively for freedom. Val ducked between beds, saw Rhea Tedder lose his grip for a twinkling. Lurene's arm thrashed once, catching herself squarely on the chin. She sagged at the blow and her husband regained his purchase. The big woman subsided into breathless sobs as the men led her into the cell. The cell door remained ajar.

Val saw the vandalized kitchen through its open door. Dark ovals of blood shared spots on the floor with a scattering of white powder that Val supposed was sugar until she heard the voices in the cell.

"I can hold her," came the deep voice between labored breaths. "Get the hypospray and a cartridge of cytovar from my office. Wait: first grab her damnable security brush and toss it in here, it might help. Can you do that much?"

The brush lay two meters from Val. She sank to the floor. A pair of feet shambled near and she heard Rhea Tedder in an old monologue as he retrieved the brush. He stood erect, paused, gave a *huh?* of surprise, and Val gave herself up—too soon. Rhea Tedder strolled back toward the cell, oblivious of the struggle Val could

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plainly hear in the cell.

Rhea Tedder paused at the cell and tossed the brush in. He spoke calmly, detached. "What about the shipment, it's all over the floor in there. Hell of a waste . . ."

"LATER," Merkle boomed. "Or do *you* want to hold her?"

The smaller man hurried away from this threat, pausing only to unlock the doors at the end of the ward. The big room was awash with light, the cell door still open, a patient moving uneasily in her bed nearby, and Rob Merkle only meters away with a madwoman barely under control, when Valerie Clarke crept to the kitchen door. She held a discarded paper cup pilfered from a wastebasket, and in one scurrying pass she scooped a bit of powder from the floor. Then she was in darkness again, frenziedly duckwalking in deep shadow toward the holo area.

Val thrust the wadded cup far down into the seam of her seat as she settled down beside Laura Dunning. She opened her mouth wide to avoid puffing as she drew lungfuls of sweet air and waited for her adrenaline to be absorbed. She had no pockets, no prepared drop, no confederates—and no delusions of well-being if her petty theft were discovered. She bit her tongue as Laura spoke.

"I've been bad, Valerie, but so were you." The sweet voice scarcely carried between the seats. "We shouldn't be here, we'll have to sneak to bed." With that, the blind girl swirled up from her seat and in an erect glide, quickly found her bed near the kitchen-lit center of the ward. Val trailed her in double-time.

Then: "Pretend sleep," Val heard—or did she imagine it?—from Laura, who took her own advice. Valerie did not, for several minutes, recover enough presence of mind to call Chris Maffei. Instead she lay facing away from the cell where Lurene Tedder lay moaning, tended by Merkle and, at his shuffling return, Rhea. Val was certain that Rhea Tedder had neither the inclination nor the guts to attack his sturdy wife. She wondered how and why Merkle, the only other person with Lurene, had chosen to punish her. Valerie had not yet grasped a shred of the truth.

"chris, oh god, chris, be there," Val transmitted her prayer of hope from halfway under her pillow.

The response was an intercept code promising live dialog after a short wait. Then abruptly, with great good cheer: "Hi, Val! I'm working late, believe it or not, but I have a little time . . ."

"you have a mayday, too." Val rushed through her synopsis of the past few minutes, adding, "you wanta come get me? i don't know what's in this cup but it's part of the shipment—and it bothers this little addict more'n his wife does. if you hurry you might be able to figure what they're up to in the kitchen and storeroom."

After a long pause, Maffei replied. "I don't think Merkle will have time to worry about you tonight. You can

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slip your sample to May, I'll have her stop by and see you tomorrow."

"tomorrow?" The word was bereft of hope.

"Look, Val, these people are fumbling something; I've only just realized what it might be. You're my eyes and ears while they do it and you could pick up something a whole lot bigger than either of us ever bargained for."

"e.g., rigor mortis . . ."

"Don't be melodramatic. I have a make on the Tedders; he's a pussycat. Doctor Tedder, all right. Doctor of Divinity from a diploma factory in South Texas. The old mail-order business, he may pray you to death but he's a harmless fraud. His wife's a reject physical ed teacher from a girl's military school, with some experience in a chemical plant—curiously, the same company Merkle worked for. My guess is, they're a matched pair of technicians Merkle can count on."

"for what?"

"You ready for this? Sleet! A refrigerated cocaine derivative the feds turned up in New Orleans last year. It avoids most of the side effects of snow—ulcerated sinuses, convulsions, stuff your higher class of cocaine addict will pay to avoid. Potent and highly addictive. Sleet was concocted by somebody pretty bright; pure snow processed with a powdered enzyme and protein. You take it with food, the enzyme comes up to your body temperature, and your stomach lining lays a swell little hit on you when the three components interact."

"you think they're cutting it here?"

"I think Rob Merkle could be the capital S source. You say soy flour's abundant there? I damn well bet it is, to keep fresh batches of enzyme going. It'd have to be slurried and centrifuged, dried—but hell, once you had the process and the enzyme, your only problem would be keeping the secret and maybe fighting off your buyers. Merkle may have caught Miz Tedder sneaking some."

Val coded a 'hold' signal and emerged slowly from beneath her pillow. She could hear Lurene Tedder speaking with the men, her enunciation mushmouthed but steady. Val employed cloze procedure to mentally fill in the words she missed and listened for several minutes, mystified. When she burrowed under the edge of the pillow again, she brought a new loose end with her. "something's not meshing, chris. merkle's asking lurene what happened and she can't tell him; doesn't blame him for anything. as if the invisible man lambasted her." It was a much closer guess than Val knew.

Maffei used her simile to press his earlier point. "It's *all* been invisible until now. You have a chance to see things I couldn't even get close to, and . . ."

" . . . and you can't see past those big boobies." The wrong moment, she knew; but there it was.

Chris answered *sotto voce*, as if to a male friend, and Val knew that May Endicott was within hailing distance

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of him. "If it'll make you feel better, she, ah, puts up a good front."

"I swoon with delight, you bastard. you could have the good sense to lie about it."

"My work is too important for lies between us, Val."

"But not too important for lays with miz randycu . . ."

"Val!" In dulcet reasonable tones: "A certain—relationship—can enhance motivation on the job." Too late he saw the sweep of that truth.

"don't i know it. but the job isn't a clean scholarly paper, the job is people—a boy who doesn't know the hurt is because nobody cares that his teeth are rotting—a lovely girl with smooth flesh where eyes should be, piecing her world together alone—kids that might be curable if anybody cared."

She could hear anger rising in Maffei's answers. For years she had used that as her motive for retreat. "And the first step is just what I'm doing, Val."

"my my. do tell me all about it."

"*We're* doing! You know I include you."

"when you think about it." Her tones, she knew, were flat; her words harsh. She should be pleading, begging him to complement her love and need but Valerie Clarke could not cling this time. "look, you have things to do and i don't need this. send— send may around."

"Right. I . . . you're transmitting oddly. Rhythm's off or something. Trouble?" He rapped out the last word.

She was glad Chris could not see the runny nose, cheeks glistening with her tears. "i'm—jumpy, i guess. forget it."

"Well—if you're sure you don't need bailout." His intonation asked, instead of offering, reassurance.

Despite her growing fear, choking back a reminder that she had clearly sent a mayday, she replied, "i'm sure. go 'way, lemme sleep—please, chris."

For a full half-minute Val lay still, commanding her small frame to stop heaving with sobs that might wake Laura. It was easier than ever, now, to empathize with children who could not expect help from Outside.

Then: "Val?"

"yeah."

"Are you really sure? I'm worried; you don't sound right."

"you want a framed affidavit? i said i was."

"I just sensed . . . as if someone had tied you up and forced you to say it. Give me the word."

"somebody did, a long time ago; and chitlins, goddammit, chitlins!"

Then the channel was silent. For a long while, sleep evaded Valerie. Self-doubt shored her insomnia. She was both losing Chris Maffei and throwing him away; the hard facts militated against her when opponents were violent and massive; and somehow, she knew, she had been witness to more than she could absorb. Sleep came while she searched for a neglected detail. She should have analyzed them in pairs.

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If Valerie Clarke awoke sluggishly, she could take comfort in the notion that the staff had managed even less sleep than she. The kitchen was spotless and Rhea Tedder, not Lurene, superintended the breakfast. When May Endicott appeared in the ward to help him, Val noted the shadows under those seductive eyes and enjoyed a nice mixture of emotions.

Twice May found Val's gaze and twice Val treated her to the briefest of enigmatic smiles. Under Laura's tutelage, Val fed two patients and there was no secret way to retrieve her problematic sample, much less pass it on. Immediately after the cleanup—always necessary with patients who fed like caged creatures—Val made her way to the holo area. May could not know Val's intent and soon followed in a manner much too bright, forthright, and amateurish.

May's greeting was tentative and too loud. Val replied in a mumble. "Beg your pardon," May said, leaning near.

"Quit calling attention to us," Val murmured calmly, "and sit down and especially, *pipe* down."

May sat as if felled. She was blushing as she studied the holo. "Dr. Maffei said tell you his communication set is damaged," she said finally. Two other patients, sitting near, ignored their entire exchange. "But he's getting it fixed now. And he trusted me as a courier. You do have something for me to bring him?" The naive brown eyes radiated concern.

A nod indistinguishable at any distance. "When I leave, it'll be in my seat. For God's sake get it out of here. And get me out, too, as soon as you can. Don't delay."

A winsome glance from May. Val wished the woman weren't so likeable. "We say 'dawdle' in these parts." Then after a long pause, in kaffeeklatsch cameraderie: "I had no idea he was usin' you like this."

"You're even stealing my lines," Val muttered the multiple entendre with relish. To soften its impact she continued, "That goddam comm set! What's wrong with it?"

"I don't know, Chr—Dr. Maffei said he must've hit it with his heel."

Val examined this datum for a moment. Only the scrambler module, a recent addition, was mounted in Maffei's car where it could be struck by a foot. And then only by someone in the passenger's side by kicking upward with one's toe. But with the heel . . . ?

The heel. Right. Val turned her head with great deliberation and, despite herself, a twitch on her lips. She said nothing, only looked volumes. And saw a furious blush mount the Endicott features as May realized her gaffe to someone intimately familiar with Maffei's car. Suddenly shamed by her meanness, Val arose clumsily without a word and wandered off. She had found the bit of paper cup by blind fumbling and let it drop into the seat in plain sight.

Val adopted a shuffling gait as Lurene Tedder entered the ward doorway with a tray of medication. The big

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woman did not notice Val's spindly person. So intent was she on something at the far end of the ward. With prickling hot icicles at the back of her head Val knew that Lurene was studying the holo region.

Quickly the woman stepped out to the hallway and keyed a wall intercom. "Dr. Merkle, Dr. Merkle," she called in smug parody of a hospital page. "You are wanted in the ward. Right now," she added with the assurance of a drill sergeant.

The intercom replied but Val could not hear it clearly.

"No, I can't, buddy-boy. I just caught me a stasher and I ain't gonna take my eyes off her." Another faint answer. "You come and see. I'll give you a faint lover this makes two in a row. I could be wrong, but can you chance it?"

Lurene Tedder marched into the ward again and, without conversation, relieved Laura Dunn of the tray. The woman never took her stare from the end of the ward and Val, playing finger games for camouflage, studied the square Tedder face. Under the pale gleam of synthoderm the skin was puffy, facial planes indistinct under localized swellings. Like collodion of old, synthoderm tended to peel around the mouth, the naked skin that showed was freckled with red scabs.

Val still scuttled down Val's backbone. Lurene's punishment had been a severe hiding across her face with her own airbrush! The eyes glittered even more deeply beneath swollen brows and Val knew that Lurene Tedder was fortunate to retain her eyesight. Yet she could be civil to Merkle, who strode into the ward at the moment Laura chose to begin dispensing dosages.

Val shuddered with relief as the pair moved past her. She hurried to Laura's side to take her 'instruction' in dispensing the drugs. A backward glance revealed that Merkle and Tedder, talking quickly, were converging on May Endicott. Val wondered whether May had the good sense to think of a cover activity, and guessed against it. As she saw her guess confirmed, Val began to hope that May would brazen or physically force her way out.

From the first moment, May's fear was emblazoned on her face. The dialogue rose in volume until Laura paused, her head cocked attentively. "She's the only good thing that's happened here," Laura said quietly, "and now she'll be gone."

May exchanged glares with Lurene while Merkle, much the tallest, looked down at May. For a second he craned his head to one side at May's cleavage, then thrust one hand into it in a lightning maneuver. May jerked her hands up—too late. Merkle stepped back to examine his prize and Lurene Tedder moved to intercept May's desperate grab.

While May darted anguished looks around her, Merkle studied the scrap of heavy paper and its contents. Brusquely he gave an order and fell behind as May led a procession to-

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ward Val's end of the ward. It seemed that they might pass outside until Merkle, with a silent thumb-jerk, indicated the isolation cell to Lurene Tedder. Val considered, for one instant, the possibility of a diversion. Flinging the tray; anything.

No one was prepared for Laura Dunning's reaction. Screaming, "She doesn't hurt anybody," Laura dived past Val and upset the tray as she flung herself at the sounds of combat.

Merkle spun to catch the lithe girl while Lurene grappled with May. He took no punishment and, with a backhand cuff, sent Laura squalling to the floor. The blind girl, hopelessly unequal to the fray, moaned as she rolled aside. She nursed her right shoulder as, still sobbing, she found her bed and lay back.

Val knelt in the spill of drugs, terrified and inert. She had never felt so vulnerable to physical violence, and almost transmitted an open 'mayday' before remembering that Maffei could not receive it.

May's body was not fashioned for the rough-and-tumble of a Lurene Tedder and, after a brief struggle, May was flung into the cell. The door slammed shut, locked under Tedder's key.

Merkle ignored Val, the drugs, and faint pounding from inside the cell, patting Lurene in the manner of a coach with a favored athlete. "You were right," he grunted. They were three meters from Valerie Clarke. "Where did she get it?"

Val hefted a bottle, wondering which skull to aim for, somehow remembering to keep her jaw slack and her eyes slightly averted. An eternal moment later Lurene hazarded, "Must've hidden it down by the holo someplace. You'll have to ask her when."

"You anticipate me," Merkle said jovially, urging Lurene to the ward entrance. As he paused to lock the ward doors, Val heard him continue. "She has to sleep sometime; it'll be simple to find out then." They receded down the hall, and Val heard a last fragment. "No shortage of time, or of scop. I told you this setup would be ideal for it . . ."

A youth began to take interest in the strewn capsules and Val scooped up the mess quickly before taking it to Laura. A corner of her brain marveled that Merkle could simply stride away from an addict's array of downers, knowing that any of the patients might ingest any or all of the drugs—or simply lie down and wallow in them. She sat down heavily on the side of Laura's bed and leaped up again at Laura's quick gasp.

"Don't. oh, don't! My shoulder," Laura moaned, and Val realized that her small mass had jarred the bed. "Valerie?"

Val answered guardedly. She could call no one, trust no one; Laura might suspect, but had no proof that Val was equipped with that formidable tool, knowledge. On the other hand, May certainly knew. And if Merkle employed scopolamine on May Endicott,

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he would soon strip the imposture bare. Val sat on her bed, trembling.

It was clear that Laura could not dispense medication. Val judged it was half-past ten, and thinking of the chaos of a dozen interrupted medication schedules in an unsupervised MR ward, she administered the dosages she recalled. Nor was she really out of character. Idiot-savant retardates had been known to demonstrate a memory far beyond that of normal people.

The docile Rankine was one of her failures. Laura had evidently stepped on the big needleless syringe which she would have used to administer his whopping dose of dilantin suspension. Val wasted half a bottle of the stuff trying to pour it past his lips, then gave it up. Rankine was not disposed to help take the dosage by this unfamiliar method very well, then. He would simply have to bear it with several others whose dosages Val could not recall.

Val lay back on her bed, vainly transmitting to Chris Maffei every few minutes. Interrupted by a low sobbing from Laura, she suddenly considered the remaining drugs. Surely a yellow valium, only five milligrams, couldn't hurt. She found one in her leftover cache and laid it to Laura's lips.

Laura took it greedily with an attempted smile. "Not enough," she confided. Val stiffened, then relaxed. Even recognizing the drug by taste or shape, how could the blind Laura know a white two milligram pill from a potent blue ten? But perhaps even ten would not be too much. If the scapula were broken, Laura's pain was surely intense. Val administered another yellow pill and lay back to narrowcast another blazing 'mayday' to Chris Maffei.

Two patients scuffled briefly. Another yodeled for joy. Val studied the narrow clerestory windows, knowing that even her very small head would not fit, presuming that she could smash the glass tiles. And if she tried to signal May, only meters away in the isolation cell, the staff could easily pick it up via monitors.

Laura breathed more regularly now, the valium taking its effect. Lying full length on her bed, Val found satisfaction in her act of loving kindness. Then, without preamble, a delicious lassitude washed through her body as through gauze. Val saw that her right hand was stroking her thigh. Eerily, it did not respond to her next command. "Stop that," she said aloud. She felt a presence not her own; it was purest intuition to reply.

Val composed another message. Deliberately unformed, not vocalized but simply broadcast thought, a cloudy montage of unease and avoidance. No effect, but her left forearm nuzzled her bud of a breast before she could stop it. On an instant surmise Val thought hard of a putrid slime, mentally smelled it, pictured it. Holding the thought, she felt something slip away. It was like a fever breaking, a fever unannounced but somehow benign, that now began reluctantly to

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loose its hold. Quickly Val visualized a smile; the smile she valued most, the dimpled puckish leer of Chris Maffei.

Then, despite her effort to halt it, her right hand patted her left wrist, twice. She watched her hands intently, a sham catatonic, for many seconds. Whatever it was, it had withdrawn. To where?

Across from Valerie Clarke lay the girl who was prone to mile epileptic seizures. Charles Clegg, the youth who had taken the hairbrush beating, stood near the girl, pointing, laughing. Below a certain level of socialization there is little empathy, and Clegg's amusement stemmed from the girl's loss of control. It was over now, at any rate, with no harm done.

Val told herself she had her own gooseflesh to ponder, then in a fresh surge of adrenaline, mentally connected the events. Lurene Tedder did not know the source of her flogging. And Val had a lucid flash of memory during *that* event: the epileptic girl had jerked on her bed while Laura Dunning, otherwise inert before the holo, sat and pounded her hand on her chair arm. Suddenly Laura's subliminal hand movement was meaningful.

Just now, the MR girl had suffered another spasm, while some unseen presence bade Val to caress herself. Who had reason to thank Val? She rolled over, lying now on her side, and faced Laura.

"What do you need?" Laura spoke soothingly, in deep repose. Val had said nothing.

All thought of keeping her cover vanished, Val answered, "You said you'd been bad, Laura. Did *you* make that woman punish herself?"

"I'm not sorry."

Good Jesus, I'm hallucinating. This isn't real. "And you thanked me just then—a minute ago?"

"I *am* sorry for that," was the contrite reply. "You're normal, you didn't need it like that."

Another thought whirled in Val's head. "I don't even have to talk out loud, do I?"

"Better to talk. Thoughts are so fast they're confusing sometimes. And it hurts sometimes."

"You don't know your strength," Val confided. "I believe you trigger those seizures the others have."

Laura could not weep tears, but she could cry. "Sorry. Sorry. Sorry. So much pain and confusion, I try to help. I'm sorry."

"You do help," Val said. "You can help now if you can listen in on those miserable sonsofbitches to see what they're up to."

A long pause, then: "Too far away. I have to take medicine to make people do things. I steal it. Can't be sure when the power will come, sometimes it doesn't. Sorry, sorry," the blind girl wept, her high forehead furrowed in grief.

Val soothed Laura, kneeling next to her, thin fingers on the girl's wrist. A rattle of keys at the ward doorway, and Val eased back onto her bed. Merkle came in first, Lurene next. They held the doors open for Rhea,

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who wheeled a gurney into the ward. Val realized then that they did not intend May Endicott to walk out of the cell, and subvocalized a prayerful plea to Maffei. Nothing. *Kicked it with your heel, you turd,* she raged.

There was no desperate speed in the preparations. Val guessed they had simply tired of waiting for answers, and had elected to overpower May Endicott before drugging her. "Laura," she whispered, "can you help May when they open that cell door?"

"It's not coming," Laura breathed, as the cell door swung open. The trio stormed the pathetic May and slammed the door.

Val flew to the cell and cursed herself for not having checked the lock mechanism earlier. No use in any case without a key, she could not lock them in, and she went jelly-kneed at the thought of entering that cell with anything less than a riot gun. From the muffled noises Val knew that May was going under sedation. Merkle's bass resonated in the cell but wall padding strained it of content.

She ran to the ward doors. Metal-faced, securely locked, as was the kitchen. But with enough mass piled on the waiting gurney, it might just possibly be accelerated down the ward to smash the doors. And smashing the wheeled metal cot itself might slow them in getting May from the ward. Val did not need a legal opinion to conclude that, with every additional step a fresh felony, the staff of Gulfview might welcome premediated murder. Whatever might have happened to the Fowler girl, Val did not relish seeing it repeated. She tugged at the gurney, wheeled it up the center aisle toward the holo area. Perhaps the chairs would serve, if she could pile them on, or enlist patients in her enterprise.

She could get no one to aid in her little game. Patients strolled over to watch, slack-jointed and empty-eyed, as Val managed to tip two seats up into the gurney. Whimpering with the effort, she pulled the vehicle near the ponderous holovision set, all of a meter wide and massing perhaps a hundred pounds. She reached to disconnect the wiring, but at least one patient knew what that meant. He wanted his program, and the skinny girl with frightened eyes wanted to pull its plug. He screamed, face twisted in sudden ferocity, and thrust Val away.

Val raced to the side of Laura Dunning, who seemed asleep but for the mobility of her features. "Laura, is valium the medicine for your power? Could you make some patients help me smash those doors?"

"Dilantin's the only thing that works," came the soft reply. "I only discovered it recently. Do you have any?"

Val whirled to her cache of unused drugs beneath her pillow. They were gone. Disoriented for the moment, she looked up to see young Charles Clegg. He held capsules in one hand while trying to bite off the safety cap of the dilantin bottle. He had seen people drink it; maybe it would taste good.

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Valerie Clarke did not know she could leap so fast, with such hand-eye coordination. She flashed past Clegg in a two-handed grab and the bottle was hers. Clegg was between her and Laura, but Val thought to circle around behind beds across the ward. It was at this juncture that Dr. Robin Merkle emerged from the cell.

He scanned the ward, saw Val, and then spotted the gurney filled with furniture. He looked almost pleased. Val saw it in his face: her cover was blown.

Val held the crucial dilantin and Merkle, the advantage. He also wielded the hypospray, which could accept pressure cartridges of anything from saline solution to curare. While he could not know Val's intention, Merkle obviously proposed to take her into custody here and now. Their eyes locked. Neither spoke. Lurene Tedder hurried to cut Val off from her narrow corridor between beds and wall.

"Easy, Rob," Lurene cautioned, and Merkle stopped to listen. Val took a step back, poised. "This li'l thing didn't get here on her own, somebody Outside will be askin'."

"If we wait it's a sure bust," Merkle rumbled as if reasserting an old position. "On the new schedule, we can process another, oh, say eighty pounds of protein." He beamed at Valerie. "Thirty hours or so at twenty-three celsius."

At this, even Lurene Tedder blinked. "We're gonna *process* these two?" Val first saw the flicker of revulsion in the woman's face, then realized what it meant to her, Valerie Clarke, and had to steady herself against fainting.

"For more enzyme. Matuase doesn't care what it feeds on," Merkle said, pleased at his logic. "These ladies will complete a perfect irony. Part of the operation, as it were."

Sickened with loathing, Val fanned a faint spark of hope that Lurene would rebel. The lump in Val's throat forbade her any speech; the pounding of her heart was physical pain. Then, with a great sigh, Lurene said, "Well, it's better tactics than planting 'em, like you-know-who," and closed in on Valerie Clarke.

The thought of herself as finely-ground fodder in some unknown enzyme production phase nearly robbed Val of consciousness, but the approach of Lurene and Merkle was galvanic. Val spun and ran for the gurney, hoping to get it underway before they could stop her. A quasi-female laugh followed her like a promise of extinction. Val collided against an inert patient, reached the gurney, began to thrust it ahead of her down the center of the ward. Even as it began to roll, she saw that she was simply too small for the task.

Lurene danced almost playfully out into the aisle, hands spread before her to intercept the loaded gurney. Val grabbed the thing she held in her teeth and hurled it at the woman, then was aware of her mistake. Val's missle connected against Lurene Tedder's forehead, but the soft plastic bottle had little effect and Lurene diverted

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the gurney between two beds. Val saw Merkle stoop to retrieve the dilantin bottle as it skittered near him. The bottle went into his pocket. She had literally hurled her last hope away, and in a stumbling panic Val fell over the huge form of Gerald Rankine, looming in his bed near the holo.

Rankine stirred slightly and opened unfocused eyes. Val scrambled over the great form and into the holo area, now devoid of its two heaviest seats. Lurene Tedder bawled for Rhea, who trotted up the ward for his instructions.

As Val cowered behind the holovision, mindless with terror, Lurene waved Rhea around while she herself took a frontal approach. Merkle moved to cut off any escape behind the beds; and the very proximity of the three triggered Val as it might any small and cornered animal.

Val flung herself into Rhea Tedder as Lurene crashed against the holo set in pursuit. Rhea found himself grappling with a small demon, all thin sticks and sharp edges, that spat and clawed as he held on. Recovering, the sturdy Lurene thrust herself away from the holo, already tottering on its stand from her impact, and then Lurene tackled Val in a smothering embrace. Merkle had time to laugh once as he saw Lurene's clumsy success, but he did not see the holo as it toppled onto the silently staring young Rankine.

Lifted aloft by the big woman, Val caught a glimpse of the holo set. It leaned drunkenly on Rankine's midriff, its great window facing his eyes, its picture transmuted into bursts of flickering light by the rough handling.

Val took two fistfuls of hair and wrenched, trying to tear it from Lurene Tedder's abundant mop. Val's throat was too constricted to scream and Lurene only snarled. From down the ward, then, floated a dreamlike, ecstatic moan. "Ohhhh, it's a *lovely* one," cried Laura Dunning, borne into an orgasmic flood of silently thundering energy.

Because Merkle was most distant from the melee, he was first to catapult himself down the aisle. Val felt muscular arms relax and, kicking furiously, vacated Lurene Tedder's shoulder. Lurene staggered, nearly fell, then began to accelerate down the center of the ward after Merkle. Rhea Tedder tried to follow but tripped over Val before he began to run.

A welter of impressions clamored in Val's head. The holo, crashing to the floor as young Rankine jerked in the throes of a truly leviathan epileptic seizure. Howls of helpless terror from Merkle and the woman, bleats from Rhea, as the three found themselves sprinting harder down the ward. Laura Dunning's cooing luxuriance in a stream of almost sexual power was lower-pitched, but Val heard it. Valerie Clarke splayed hands over her ears and blanched an instant before Merkle impacted against the great double doors.

Merkle, with a hysterical falsetto

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shriek, never even raised his hands. He slammed the metal door-facing with a concussive report that jolted every patient, every fixture. Head-first, arms and legs pumping, driven by two hundred and sixty pounds of his beloved protein, Dr. Robin Merkle comprised part one of Laura Dunning's battering ram.

Lurene Tedder's last scream was entirely feminine; she managed to turn her head to one side as she obliterated herself against the sheet steel.

The doors, bent under Merkle's hapless assault, flew ajar; a lock mechanism clattered into the corridor beyond as Lurene fell into the opening. Rhea Tedder, ever the rear guard, called his wife's name as he hurtled into the space. One shoulder caught a door frame with pitiless precision, hurled the door wide as the addict

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ricocheted into a corridor wall. Val, leaping to her feet, saw Rhea disappear down the corridor, lying on his side still pantomiming a sprinter's gait on the floor. He did not stop for moments afterward; Val could hear the tortured wheeze of his breath, the ugly measured tattoo of his feet and arms beating against the corridor floor and baseboard.

The patients were shocked into retreat from the violence at the ward doorway, and none seemed tempted to approach it. For one thing,—*two,*—the remains of Rob Merkle and Lurene Tedder sprawled grotesquely in their way.

With all the caution of a nocturnal animal, Val rifled Merkle's lab smock. She found the hypospray intact and felt armed; then she hefted the dilantin bottle—and in a moment's reflection, realized that she was doubly armed. As she faced her puzzle, odd pieces began to warp into place and, for the first time in many days Valerie Clarke knew what it meant to smile in relief.

Quickly, gently, Val checked for vital signs. She saw the ruined, misshapen head of Robin Merkle and knew why he had no pulse. Lurene Tedder lay dying, insensible, extremeties twitching. In the hallway lay Rhea Tedder unconscious from shock and fractures his breathing fetid but steady. She judged that he would live. Her small joy in this judgment was proof that Val could still surprise herself. It was true that Rhea Tedder could answer crucial questions but it was also true that he could ogle a homely girl. She made a note to tell Chris Maffei: *Blessed are the easily pleased, for theirs is the kingdom of Earth.*

The corridor intercom needed no special key. She punched Outside, idly musing at the closeness of help for anyone who could reach the corridor. In moments, a policewoman was taping her call.

Two minutes later Val reentered the ward. She opened the isolation cell with Merkle's keys, once again tense almost to the point of retching with thoughts of what she might find inside. May Endicott lay sprawled in fetching disarray on the cot, drugged to her marrow but apparently unhurt. That enviable body would decay one day, Val thought; but not today, at twenty-three degrees celsius. She could see from a distance that Gerald Rankine had passed the tonic stage of his seizure, and was well into the clonic, his body jerking slightly as the effects of the monstrous seizure passed. She moved to Laura Dunning's side. It felt good to smile again.

Val wondered how to begin. "I have news for you, Laura," she said gently.

Laura was awake but, with the valium, quite mellow. "I know. I did it without the medicine," the blind girl said proudly.

"Well—yes and no. It's seizures by other people that bring on the power, Laura. No wonder you couldn't tell

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when the power would come: *it isn't your power!*"

Confusion wrinkled Laura's nose. "But I make people do things."

"Can you ever," Val agreed, "but not alone. You're a—a modulator, I suppose. Rankine did not get his dilantin today; and that could've brought on a seizure by itself. You see—oh, excuse me,—you understand, whenever you stole a dose of dilantin from Rankine or that young girl, the patient who needed it was in danger of an epileptic seizure. But the surest way to bring on a seizure is a strong blinking light—and that holo set zapped poor Rankine into the grandpaw of all grand mals, thank God."

"My," Laura murmured with a secret smile, "but it was good. But you mean, I never needed the medicine myself?"

"It probably impedes you. You need a carrier wave from some strong source, and you manage to modulate it into commands. You know what electroencephalography is? Anyway, a real thunderation seizure comes with the damnedest electrical brain discharge you can imagine, far more intense than any normal discharge. Of course, that same intensity raises hell with the higher centers of that same brain. Like trying to send morse code through a flashlight, using lightning bolts." She raised her hands, then let them drop in frustration. "All I know is, you've gotta be sensitized in some way to modulate other people's brain discharges into commands. Normal brain activity just doesn't feature such power; those huge discharge spikes are characteristic of epilepsy. All this is simplistic but I haven't time to detail it now." *Nor understand it yet,* she thought.

Laura sought Val's hand with her own. "You know something about these things? You'll stay with me?"

The idea settled over Valerie Clarke like a security blanket. "I've learned some from a man. I need to learn more." This astonishingly gifted girl needed her, Val realized. Her smile broadened as she stroked Laura Dunning's brow. "I'm going to claim Rhea Tedder went berserk and stampeded the others into that door. It's a weak story, Christ knows, but it'll accommodate the facts you can see." The ethics of her decision disturbed Val until she remembered Rhea Tedder holding her for the processing team.

A sigh from Laura: "I wish I really could see."

"Don't you? Through other people?"

As if showing a hole card, Laura said, "Kind of." Her hand gripped Val's desperately. "If I could do it better, I could help some of my friends here a lot more. Some of them are trying to climb walls in their heads, to get out to us."

It was possible, Val admitted to herself. And who would be a better tool than an honest-to-God telepath? With a machine-generated carrier wave, could Laura reinforce improved behavior patterns in a trainable MR?

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The possibilities were untouched, and staggering. Chris Maffei had spoken of Gulfview's problems as the devil he knew, but Val smiled at a new thought: *the devil you don't know may be an angel in disguise.*

"Who've you been talking to at night?" Val realized that Laura had, at the very least, known of the transmissions at her end.

"Dr. Christopher Maffei," Val answered. Curiously, it sounded flat. The name no longer held its familiar emotional lift. She considered this further.

"Can he help us—me?"

"It's." Val's correction was an implicit promise. "Yes, but he's a proud man, Laura. He'll want to make you famous." *Because it'll make* him *famous*, an inner voice added.

Slowly, Laura replied, "I don't think I want that."

"We may be more useful without it." Val agreed. "But I know Chris, and he has strong opinions." She grinned at a sudden unbidden thought. "'Course, you could always run his opinions off a cliff—and I'm kidding, by the way."

After a long pause Laura asked, "Do you love him?"

Since Laura could probably sense a lie anyway, Val resolved to use utter candor. "Yes." With a starshell burst of insight Val added, "But now I don't think I need him much. Does that sound harsh?"

"Your thinking isn't harsh. And Dr. Maffei: does he need you?"

Put in such blunt terms, the questions brought answers Val had never formalized. They hurt. "Yes; but you see, he's never loved me much."

"*I* love you." Laura's admission was shy, tentative. "But I don't think it's the same, is it?"

Val chuckled. "'Fraid not. But it's enough. Was it Vonnegut who said the worst thing that can happen to you is not to get used?" A new resolve sped Val's answer. "In a few minutes a whole raft of people will be here to turn everything upside down and set it right again. You're sedated, baby, so you be goddam good and sedate! Keep your ability to yourself, don't force any automatic behavior on anybody, don't even hint about it—until I come for you. And I will."

The hand tightened again over Val's thinner one. "You have to leave?"

"For a while. Weeks, maybe. But you and I will figure out how you tick, and we don't want Chris Maffei diddling with your metronome so he can compose a bestselling ditty with it. Later, maybe. And maybe not. The trick is being used properly, isn't it, Laura?"

"You're the boss," Laura said meekly. And listening to police beepers in the distance, Valerie Clarke knew that she was, indeed, ready to assume the leaden mantle of decision-making. She wondered if Maffei's scrambler unit was repaired yet. It was the simplest of matters to find out, but Val could wait. There was plenty of time for her to put Maffei to use. ■

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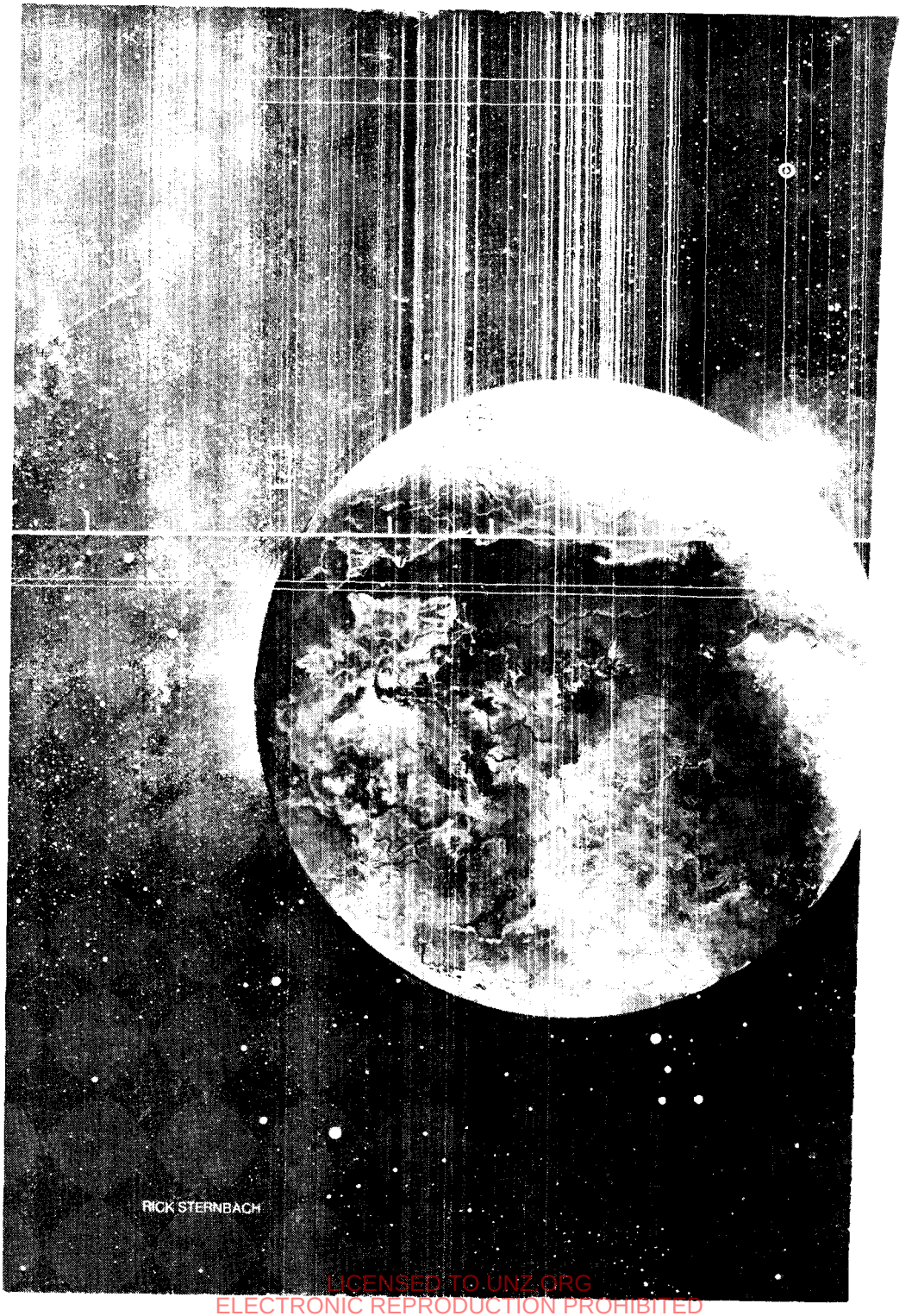

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the promised LAND

When you use a tool— is it using you?

STANLEY SCHMIDT

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Only when the Earth and Kyere were inside M31, and starting to slow down from a million times the speed of light, did the Kyyra scout ships dart ahead to go house-hunting.

Earth and Kyere braked slowly, relatively; a planet makes a cumbersome and fragile spacecraft. Even with a deceleration bordering on recklessness, they would take some four years and fifty thousand light-years to come to rest. At the beginning, no stars, no visible evidence of the galaxy around them, would be seen. And at the end, they would have to halt in a well-chosen place, for there would be no second chance.

So the scout ships went ahead. There were ten of them, at first—small (compared to a planet), refuelable, agile, and maneuverable. As the refugee planets began the long process of stopping, the ships plunged on at full speed. Mere weeks later, at the far higher accelerations they could use, all but one of them slowed and dropped back to sub-c and the first starlight they had seen in years.

Humans and Kyyra, back on their lumbering planets, welcomed the news, sent back by the timeless communication "beams" of the Kyyra. And then they waited—for the news they needed was far more specific than the mere fact that stars still existed.

For a year, more or less, the scouts mapped skies containing nothing familiar, identifying, analyzing, cataloging the stars they could see. The ship that had not slowed flew on alone toward the galactic core, to make sure it had not suffered the same fate as the one they had fled. All the others concentrated on the tiny region of spiral arm where they had emerged, learning which stars were nearby and might harbor habitable planets.

And then came the tedious task of checking them out. The ships, dividing the stars among themselves, went for closer looks, approaching each prospect as closely as they must to determine that it did or did not have a planet that might be called habitable. Most did not, though sometimes far too much time was wasted before that was known. And time (as usual) was short.

A handful of stars had planets which could serve. None was perfect. Humans and Kyyra—most of them, anyway—greeted each report with eagerness at first, and ended by hoping the next few weeks would bring something better.

Eventually no more weeks could be spared for waiting and hoping. By then the planets also saw stars again, and it was time to set their final courses. The leaders of men and Kyyra conferred. Decisions were made. Not perfect decisions, but decisions which would have to do.

"You're sure we have to decide now?" Jonel Turabian's dissatisfaction showed plainly—at least to his wife and co-administrator Sandy—in a slight scowl. "We can't let them keep looking a little longer?"

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"I'm afraid not," said Beldan. The tall Kyyra ambassador, seated across the small round conference table from Jonel and Sandy, looked no more content but resigned. "There's only a little more than a year left. We'll have to start course corrections very soon to get wherever we're going. You can't do these things suddenly, with a planet. The scouts have exhausted the stars in their original survey zone. They've done a little additional looking, but they haven't found anything really worth checking out, even if they had time. So we must choose one of the planets we know about, and be on our way."

"Hmph." Jonel looked down at the summary sheets before him. Sandy scanned hers too, though they had both been over them so often as to have them practically memorized.

One of the two farthest-reaching decisions in human history. Sandy reminded herself—a choice among five planets all described by such meager data that it was hard to decide which was the most desirable (or least objectionable). Time was part of the problem, of course. It was a real tribute to the Kyyra explorers that they had been able to find even this much in such a short time. With the pressure they were under, there could be no hope of more than scratching the surface, of delving into the myriad subtleties that make a planet a world.

But there was more than that. The Kyyra culture was technologically so far removed from raw nature that they had little feel for what was desirable or dangerous in a virgin planet. The basic physiological requirements of both species—gravity, atmosphere, biochemistry . . . —they knew. But the far trickier factors which can shape a civilization were quite unfamiliar to them. Their civilization was shaped too long ago.

"It's too bad," Jonel said wistfully, "we didn't have humans on the scout ships."

"Perhaps," said Beldan. "But you know that wasn't practical, and little will be gained by dwelling on it now."

"I know. So we have to pick one of these." He peered somewhat distastefully at the sheets, holding them almost at arm's length to compensate for recent changes in his vision. "Let's see . . . this one has a pretty high gravity and metal content, leading to a lot of volcanism. A bit too exciting, and the day's a good deal longer than we'd like, but everything's at least marginally within acceptable limits. Except that the atmosphere's prepolluted with enough sulfur compounds and such to make us doubt long-term safety. Scratch that one."

He flipped to the second sheet. "Everything very nicely within limits—but the local ecology uses all the wrong stereoisomers. We'd be completely dependent on food we brought with us—and we definitely don't want that."

His scowl deepened. He flipped to the third. "Another pretty nice place, in itself. But you didn't look very

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closely because a neighbor at three light-years is a bad risk for a supernova. We don't want any more of that."

The fourth. "Short day, crazy tilt, hyperactive F3 sun, violent weather, primitive ecosystem. Almost no life on land; no soil to try farming with any plants somebody might have kept alive. We could live there, maybe, but we'd rather not try.

"Which leaves this." He stared at the fifth and final report. "Not bad. G4 sun, twelve-degree tilt, nice homey atmosphere and gravity, fairly familiar day and year lengths, some native life forms we can eat. Nothing blatantly repulsive about that."

"And yet," Beldan said, "you have reservations about it?"

"That's a fair way to put it. Two things. First, I get the impression—though it's hard to be sure—that it's geologically younger than Earth. Not a lot, but maybe enough to make fossil fuels scarce. Second, its density's a bit low for its size. Together with its sun's spectrum, that suggests metals are scarce too. I can see even more possible ramifications, but those are enough to make me hesitate."

"But are they really so important? Low abundance is inconvenient, but it's not the same as absence. The planet is somewhat larger than Earth. More area to mine may compensate for lower relative abundances."

"Possibly. But it also means more hay per needle."

Beldan frowned. "Perhaps. But we have insurance against such problems. We'll have to take the Earth fairly close for the transfer operation. We can park it more or less permanently as a reserve supply of resources. Zhalãũ assures me it can be done. We won't be able to go close enough for a truly stable orbit because that would disrupt the tides too much. But we can get a compromise between distance and stability that'll let us tap the Earth for as long as we're likely to want to."

"Yes," Jonel muttered. "And since you have the only operational spaceships, dependence on the Earth means human dependence on the Kyyra."

"May I remind you," Beldan said quietly, "that we are at least equally dependent on you in other ways? We're all in this together, as Henry Clark used to say. It pains me to see you concerned about this. After all we've been through, I would think you'd be convinced of our good will."

Jonel smiled thinly. "Sorry. But after all we've been through, I'd think you'd realize we're a distrustful lot. Maybe we shouldn't be, but we are."

And you, Sandy thought in unspoken aside to Beldan, *will become more and more so, with the Coordinator no longer molding your minds.*

Or maybe you already have. Is it my imagination, or are we all a bit edgy today?

"Actually," said Beldan, "we Kyyra were most concerned about the presence of large predatory animals. But I don't think that's really a serious objection. It should be no great problem to exterminate them."

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Sandy nodded, but with reservations. "Probably. But only if we're driven to. We exterminate only what we must."

Beldan eyed her with a look of slight perplexity. "You sound as if there would be some question about it."

"There would. We're determined to treat this planet better than the last one—and that means working with the ecology more than against it. Now that we've been through the shock of destroying everything we lived with, we want to be very sure we never do anything like that again." She saw the look of growing chagrin on his face, and thought of what she knew of the worlds the Kvera had lost—from which the last natural life-forms other than Kvera had long since vanished. A shattering realization dawned. "You found us if you want to make this World into another Kvera!"

He nodded. "As much," he said. "I was going to make it into another Kvera."

He took out his music-pipe and began to play. And Sandy felt herself teetering on the brink of the rift that had opened between them. She had never really thought about just how irreconcilable their actual goals might be.

"I don't think," Jonel said quietly, though his face mirrored Sandy's concern, "that this is what we have to settle now. Our only problem now is to get down."

With an effort, Sandy dragged her mind back from that imaginary edge.

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Jonel was right. "We seem agreed," she said, "that this planet is the one. How do we get onto it? What do our people have to do?"

"I'll outline the method," Beldan said with obvious relief, "and give you our most pessimistic estimates of the precautions you should take. Chances are that things won't be that bad. But better too much care than too little—"

Another shock. "Wait a minute," Sandy broke in. " 'Estimates,' you say. Haven't you done this before?"

"Not exactly—"

"But you told us—"

"That we had moved planets? Indeed. But not with such haste as we had to move Earth or Kyere, or with the extra indignities we had to inflict on Kyere to search for people like you. And we've never had to quickly evacuate a whole population from a planet that we'd just moved. The methods involve rather delicate manipulation of the last remnants of the exhaustless drive reaction—qualitatively similar to some of the things we've done to hold the planet together during the high-acceleration phases, but even more delicate. We couldn't have done it even a few years ago. But the alternative was to do it with ships, and that's more impractical than strip-mining with teaspoons, especially now. So we had to learn, and we did. Zhalãũ's engineers have been working intensively on developing the techniques ever since you joined us. We feel quite sure they're ready to use."

But you've never actually used them, Sandy thought. *So you don't really know.*

She listened patiently, if somewhat apprehensively, through the explanation that followed. It was not very detailed—Beldan promised full details in the near future—but it gave a good general idea of what lay ahead. Half an hour later Beldan rose, smoothed his iridescent (though slightly faded) robes, and took his leave. He moved with peculiarly sinuous grace in the weak gravity produced by what remained of Earth's mass. Actually it was even weaker than it now appeared, for part of the apparent gravity was due to the planet's deceleration. And that changed the effective up-down direction enough that the present sloped "floor" was normally the north wall, and Beldan had to climb a ladder up the usual floor to the door.

"Well," Sandy said when he was gone, "it looks like we have our work cut out for us."

Jonel nodded. "Yes. And in our spare time, we'll have to get out as much information as we can on the new planet."

"Which isn't likely to be much, from what Beldan says."

"Probably just as well. We're not going to have time for much except getting ready to land." He thought for a moment and added, "And that's going to involve a lot more than logistics and hardware."

"Like Moses?"

Jonel nodded solemnly. "He'll be getting ready, too."

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He had called himself Moses for so long he had almost forgotten his given name. And he'd been in so many unfamiliar little rooms like this that they all came to look alike. The constant moving about had always been wearying, and it had been even harder during the high-acceleration phases that had occupied most of the last several years. With much previously available transportation now unusable, he was more dependent than ever on wangling government jobs that gave mobility and opportunity. It had been necessary, to keep the Movement and himself in the public awareness, but woefully inefficient. To avoid suspicion, he had to actually work at the jobs he held, and that sapped both time and energy in ways not directly contributing to the Cause.

Now, maybe, it would all pay off.

He finished checking the room for bugs—something he never failed to do personally—and eased himself into an old wooden armchair with loose joints and peeling paint. He cast a perfunctory glance at the chunky, red-haired young man sitting among the bare recycling pipes, then clasped his hands in front of him and closed his eyes. "So. You have news?"

"Yes," said Griffith, whose legal name was no more Griffith than Moses was Moses. "You know they've announced the choice of a target planet. I have some details they haven't made public yet. If they're ready to get specific, we'll want to, too. This is it, Moses. The home stretch."

"M-m-m." Moses opened his eyes and leaned forward to take the scrap of paper Griffith held out. He looked at the heading and smiled. "Clark's World, eh? So they're naming it after old Caesar Clark. Hardly surprising. Well, we can use that. But carefully, Griffith, carefully. Such people tend to get deified, once they're safely dead. The living have to tread cautiously when they try to trample a dead god." He skimmed over the rest of the sheet and passed it back to Griffith. "What else?"

"The main thing at this point is propaganda. We've been steady but low-key since we worked back up to the surface after high-acceleration started. Now it's time to become high-powered and hard-hitting. The name angle is a good starting point. Beyond that . . . we can use details on the new planet to stress the most unpleasant features of going there. Dust off all that wonderful old imagery of yours about sunburn and water falling out of the sky when you have no roof over your head—"

"No." Moses shook his head wearily. *Was I like that at his age?* he wondered. *Maybe so. But I've learned . . .* "You're not thinking," he told Griffith. "That was appropriate a decade ago, when we were trying to cure people of wanting to reach a new world. It's not appropriate now; it's too late. We're going to reach it now, ready or not, and Earth is ruined as a permanent residence. There's no point

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in making people feel miserable about the inevitable. We gain nothing by whipping up emotion unless it serves our higher goals." He paused thoughtfully. "Besides, they know about those things. The Turabians' colonist education program has given a fair picture of what they can expect, even if it has had a positive bias."

"Sorry," said Griffith. "I was only thinking—"

"You weren't thinking," Moses repeated. "I'm sorry if that seems harsh, but that's the way I see it. Before you lay out a plan of action, Griffith, you have to have clearly in mind what you're trying to achieve. You do know what we're trying to achieve?"

"Of course."

"It's to help people," Moses said quietly, "to get through the transition as painlessly as possible. And to give them back their freedom and dignity. To make sure we get rid of the dictatorship we've been saddled with since this all began."

Griffith allowed himself a slightly teasing smile. "It couldn't be that you have any dictatorial ambitions yourself?"

"Don't ever say anything like that again. Ever." But as Moses glowered, he thought, *It would be distressingly easy, if things go right. I've become a folk hero, of sorts—just by managing to stay uncaught and keep giving speeches for this many years. They see me as a sort of Robin Hood, or something. A droll contrast to the way I see myself. Forty . . . bald . . . I'd be getting a paunch, if I got enough food to support one.*

But in politics, it's the popular image that counts. I could use it, if I wanted to.

Griffith, startled by his reaction, muttered, "Sorry. But you are planning to take over the government—"

"Temporarily. Only temporarily. Only long enough to make sure we get rid of the house that Clark built."

Griffith grew bolder. "But if that's all you want, why take over? Why not just smash the existing government and let grow what will?"

"Because I'm not just a nihilist. If I smash what exists, I have a responsibility to put something better in its place. Things are going to be rough down there, Griffith. We're going to need all the cooperation and leadership we can get."

"And you're it."

"Yes." Moses frowned, reappraising his sometimes shaky confidence in Griffith. "The alternatives are to leave things headless, or take a chance on somebody else taking over. I know I can trust myself. I don't know about anybody else." *And would any of it be for my own profit? Of course. I hope to enjoy it while it lasts. And I might draw a little more of what the new world has to offer than most people.*

But I'll earn my keep.

He tossed his head impatiently. "We're getting sidetracked. We're here to plan actions. Okay. We step up the publicity, first of all. Not to make people feel negative toward the planet, but positive toward us, the liberators. 'With the Turabians all the

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way down, and not a step farther.' That sort of thing."

Griffith nodded. "'They take us down, then we take them down.' 'The emergency stops at the surface.'"

"Not bad. Just don't underestimate the popularity the Turabians still have. Work out the details and check with me. Meanwhile, it's none too early to start thinking about the takeover itself. What do we know about their plans for moving down?"

"Very little, yet. But we'll be watching."

"Good. The sooner we know what they're doing, the sooner we can plan how to use it."

Beldan had another Kyyra with him when he came down the Turabians' ladder for the third briefing session. The new one, to judge by the smoothness and clear bronze hue of his skin, was much younger than Beldan—quite a young man, by Kyyra standards, though in actual years quite possibly at least as old as Jonel or Sandy. He waited awkwardly when he reached the bottom of the ladder; like most Kyyra, he made no attempt to affect human facial expressions. Beldan gestured at him. "May I introduce," he said with a faint frostiness painful to Sandy, "your pilot, Qabrim."

"I am pleased to meet you and glad to be of service," Qabrim said in English almost as good as Beldan's. He looked at Sandy. "You and I have already met, Mrs. Turabian. Do you remember when you visited our convoy ship that brought Beldan to Earth, shortly before Henry Clark approved the move? I was one of the young rowdies at the next table in the gathering hall."

"Oh, yes." Sandy smiled with instant recognition, not of Qabrim as an individual, but as part of a scene etched indelibly in her memory. "The musical pun."

To her surprise, he ventured an approximation of a human smile. "Yes. I hope Beldan did not try to translate for you."

Sandy laughed. "No."

"Qabrim came two days ago," Beldan said. "The pilot station in Titusville is complete, and the crews are making provision for moving your government headquarters there when the time comes."

"With all due attention to secrecy, I trust," said Jonel. "I can't overemphasize how important that is. Moses almost stopped us from going to high acceleration, and he's been a thorn in our side ever since—a very slippery thorn. We're sure he's going to try a coup no later than planetfall. Everything we do, we're going to have to do with as little publicity as possible."

"Of course."

Jonel turned back to Qabrim. "Two days. Have you started your schooling yet?"

"Barely."

"Let us know how it goes. We're not really satisfied with that program, but we'll do what we can to make it as helpful as possible." The Kyyra would be even more dependent than humans

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on training for survival on Clark's World—yet their location, on Kyere and distant convoy ships, had made it impractical to send them nearly as much as humans had received. Their main hope was that the pilots they sent to Earth now could absorb enough in the year before planetfall to return to Kyyra settlements as teachers, aided by human volunteers. Not satisfactory, but—like so many things—it would have to do.

"There's only one of you," Sandy observed. "Did you come alone?"

Qabrim nodded.

Jonel looked sharply at Beldan. "No co-pilot?"

"There were not enough. We sent all we could."

"But . . ." Jonel frowned. "Flying a city must be a tricky business, and there are a lot of lives at stake."

"Very true," Beldan agreed. "But there are a lot of cities, too. We kept the number as low as we could; some are actually bulkier than we'd like. You're lucky we were able to give you even one pilot for each."

"I understand that. The safety element still bothers me." It bothered Sandy, too. The thought of a slab containing an entire city being severed from the Earth and flown down to Clark's World was unnerving enough without its being in a single irreplaceable pair of hands. Jonel pondered it for quite a while, then asked Beldan, "Could humans learn to do it?"

Beldan, with a glance, referred the question to Qabrim. The younger Kyyra said, "It's hard to say. Offhand, I see no reason why not, anyway for a human with prior experience with spacecraft or possibly large aircraft." His face changed expression—in an unreadable way, but Sandy suspected he would have frowned, had he known how. "Except that every city is different, and we all had practice on simulators which would not be available to you. I wouldn't want anyone without simulator experience to act as sole pilot, except as an extreme last resort. But enough is automatic that such a person might learn to do a good job with a limited group of controls."

Jonel looked dubious. "Would that actually be good for anything?"

"It could. If the pilot were partially disabled, or the job unexpectedly became too big for him. Separation, for instance."

"Separation?"

"If parts of the city should become separated in flight, additional actions would become necessary to land them separately." He seemed to recognize both humans' alarm and added, "We have provisions for doing it; they just put excessive demands on one pilot. It's most unlikely, anyway. It would take a large external force applied too suddenly for the structure stabilization to respond to. A large meteorite, for example, shortly before landing, when the drive reaction is almost dead and hard to control."

Very unlikely, Sandy agreed. *Still, the more I hear about this operation, the less confident I feel.*

"So an assistant would be helpful,"

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Ionel said, "just in case. Okay—it's better than nothing. Qabrim, I'll learn whatever you can teach me about handling Titusville."

Qabrim looked at Beldan. "Objections?"

Beldan shook his head. "No. I only wonder about your doing it personally, Ionel. You two already have a staggering workload."

"But nobody else in the Titusville zone has my experience. And if the pilot station is going to double as government headquarters, I don't want any unnecessary outsiders anywhere near it. I'll find the time."

"There aren't enough experienced pilots to assign to all the cities," Sandy pointed out. "Could nonpilots help?"

"Probably," said Qabrim. "But in a more limited way."

"Then I'll try to learn as a backup for Ionel. Titusville's going to be especially crucial. And we'll recruit copilot trainees for all the towns. Pilots when possible, others when necessary."

Beldan looked faintly disturbed. "I hope this isn't going to occupy too much of our pilots' time. We're depending on them for other things."

"You're also depending on getting them down in one piece. It'll add a load on all of us, we'll just have to see that it doesn't get too big. But we'd better do it."

Ionel nodded. "And we'd better choose the candidates carefully. Everyone is a security risk—exactly where secrecy is most essential."

"Secrecy?" Moses smiled with mildly cynical amusement. "We'll have to see what we can do about that." Seated in a rickety wicker chaise in yet another room he had never seen before and would never see again, he scanned Griffith's latest report. "Flying cities, eh? Well, why not, after what they've already done with flying planets? With Kyyra pilots in secret locations. Naturally." He finished reading, then glanced quickly over the whole thing again. "Very good, Griffith. We'll need lots more details, of course, but this gives us a definite starting point. I already see the outline of how we'll proceed."

"You should spend some time with the other sheets, too," Griffith suggested. "They've issued some pretty harsh warnings about opportunists trying to use the confusion of landing to seize power, even locally. And they're prepared to back them up."

"Well, of course. Our agitation's beginning to get to them. Naturally they'll issue warnings."

"But we'll have to be careful. These warnings have teeth, Moses. They've developed a pretty potent arsenal, and ways of getting it where it's needed. Even after we're down."

"Of course," Moses repeated imperturbably. "That's what we're going to use. Look, Griffith—it wouldn't be easy to build up the machinery to run that whole planet ourselves; I'm not sure it would even be possible. It's been hard enough just to build an underground network of the magni-

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tude we have. But the government already has administrative machinery, and ways to keep it running after we're down. So what do we have to do?"

"Take over what they have."

"Exactly. We can expect to seize each individual city. And if I personally take the part that holds the reins for the whole works—that's all we need."

"It sounds good," Griffith admitted, but with a hint of doubt. "They say there'll be five thousand cities, Moses. That's a lot of targets, and a lot of risk."

"And we have a lot of contacts. Very good contacts. We'll manage."

"Hm-m-m." Griffith looked away. "I'm not questioning you, Moses. But have you ever wondered whether this is all really necessary? The Turabians claim that one of their first priorities after we're down is a smooth and fast transition back to self-rule. Suppose—just suppose—they actually mean it."

Moses eyed him narrowly. "Are you willing to take a chance on that?"

For a moment Griffith looked as if he would capitulate as usual. But then he thrust his jaw slightly forward and said quietly, "I'm not sure, Moses. I've been thinking about it, and I'm just not sure. The risk isn't just to us. It's to all the people we say we're doing this for. The kind of takeover we're talking about is going to mean bloodshed and extra danger. If there's another way, wouldn't that be preferable?"

Moses pressed his lips together impatiently. "You think there is another way?"

"I don't say there is. I say we should make very sure there isn't. The Turabians have spelled out a pretty specific plan for easing themselves out of power—"

"And you think we dare believe them?"

"We can negotiate safeguards to make sure—"

"Negotiate? Come on, Griffith. We can't even show our faces."

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"Not us, directly. Citizens' groups under our influence."

Moses shook his head vigorously. "Dangerous thinking, Griffith. You've got to understand what we're up against. This is the first real world-wide dictatorship we've had; our goal is to make sure it's the last. No matter how benevolent it may seem, it's too dangerous to tolerate any longer than necessary. Trying to negotiate with it—even if it would admit to having time to talk—is out of the question. It's so firmly entrenched that its word is meaningless. It can promise anything—and then do whatever it wants. The only way to be sure we get rid of it is to get rid of it—by force. I don't like it either, but there's no alternative." He paused and looked darkly at Griffith. "So how do I count you? Help or hindrance? Friend or foe?"

Griffith didn't answer immediately. But after a few seconds he said, "I'm with you all the way, Moses."

"That's better." Moses, though still not quite satisfied, returned his attention to the report. "This thing's much too sketchy. The first thing we're going to need is details—like exact locations of pilot stations and government headquarters." He snorted. "To onfounded government secrecy! Last time we were on the verge of a coup, we had to track down the control stations for the planet's drive. Now it's pilot stations for cities—and this doesn't even specify which cities they're using." He looked at Griffith with sudden fierce determination. "But we'll find out, won't we? We have ten months."

He laid the sheet down, leaned back and looked up at the drab ceiling. "Meanwhile . . . we're going to need all the popular support we can get. We have a loyal following, but it's too small and the campaign we've been waging is too mild. The public at large is too enamored of Clark's memory and the Turabians themselves to help us throw them out. We need something really potent to turn public sentiment our way. Do you have any ideas, Griffith?"

"Nothing I haven't already mentioned."

"I do," said Moses. "You know, even before she came to power, Sandy Turabian was widely known as the closest of all humans to the Kyyra. Wouldn't it be interesting if something turned up to provoke a sudden wave of anti-Kyyra feeling?" He chuckled dryly. "Of course, there's a rumor that things aren't all peaches and cream between them right now, but that doesn't have to interfere. Maybe we can even use it, if there's anything to it."

Griffith's eyebrows rose and fell. "Do you think it's wise to antagonize the Kyyra before we're down? We are dependent on them—"

"And they on us." The shadow of a thought darted across Moses' mind, but he couldn't quite catch it for a close look. "I didn't say we should

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antagonize them, Griffith—though I didn't say we shouldn't, either. We're looking for strong medicine." He dismissed Griffith's discomfiture with a light laugh. "Just investigate, Griffith; that's all I ask—for now. You know, there's always been some feeling against the Kyyra. I imagine there was quite a burst of it back near the beginning, when somebody found out that Henry Clark had single-handedly made a deal with them.

"Who knows what else we may find?"

Education—in a very broad sense—had been the dominant task of the Turabian administration from the start. It remained important into the final year, but it changed character. And, to a growing extent, it was crowded aside by other matters.

Initially, it had been a matter of general survival training—conducted half-blind. Once high acceleration started, the preparation for it that had dominated the previous twenty years became a thing of the past. Those who had prepared well (and were lucky), survived (though not much more) with relatively little further effort. Those who had not, could do little to improve their chances once the build-up had begun. At that point, there was again a need for something to occupy people, and it was none too early to begin getting them ready to colonize New Earth.

But nothing was yet known about New Earth—not even its identity or location. So the Turabians sought out people who remembered and could teach any skill that might prove useful—woodcraft, farming, hunting, fishing, mining, metal-working, textile-making . . . They knew well that specific techniques were not likely to be directly applicable. The real hope was that knowing them would give people some basis for inventing the new skills they actually needed. But that seemed so important that major efforts went into recruiting teachers and making their knowledge available via the comnet.

And with it went a vigorous program to renew people's belief that it was all worthwhile. No survival training program could minimize the hazards that would surely be found on a new world—hazards which might well seem temporarily worse than the rigors of flight. It was vital that people realize—especially young people who couldn't remember what a planet could be—that beyond the initial obstacles lay the potential for something better than they had ever known.

Now, with New Earth—Clark's World—chosen and being explored, the comnet could finally give some specifics. One channel carried a continuous picture, so people could watch their new sun brighten and grow with the passing weeks. But there were too few hard facts. The eight remaining scout ships, charged with finding several thousand usable landing sites within a year, had little time for close study of the places they visited. So the reports they sent back were infrequent and sketchy.

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And the occupants of Earth and Kyere had little time for study—for this last year, as the planets veered slightly on their homing "beams," must be given largely to logistics. The human survivors, in particular, were too scattered. All, before the year was out, would have to be gathered into the major population centers designated for transport by the Kyyra. That was no small task. There were nowhere near enough transportation facilities to move everybody at once. Priorities were too often too easy to decide; in many areas the extreme tilt and lack of suitably modified transports made it impossible to start relocating until the acceleration had decreased, and the decrease didn't begin until halfway through the year. People who had to wait worried that their turn would never come. Those whose turns came early suffered long exposure to crowding conditions even worse than they were used to—with all the tensions and frictions that implied.

The tensions and frictions were not alleviated by Moses' ever more insistent propaganda. Counteracting that—and trying to end it—consumed a growing amount of the Turabians' time and patience. They understood Moses' distrust of the existing government and its avowed intention to do away with itself; the problem had plagued Henry Clark from the very beginning. But they couldn't simply let Moses have his way, for he gave every indication of being that most dangerous animal, a Man with a Mission—who had not yet consciously realized how attracted he was to personal power. Yet the prospect of widespread violence and destruction to block him seemed cruelly unnecessary—especially when they knew he could not win as much as he hoped. Even as they publicly fought his propaganda with their own, privately they tried desperately to talk to him, to convince him there were other ways.

But every effort they made, he rejected out of hand.

It was conceivable that Moses might have nothing to do with the most ominous element of the growing unrest. But it wasn't likely . . .

Three months to go.

Aldo Wisniewski, World Director of Education, looked as much like a football coach as anybody could under today's conditions. Big and burly, with black hair tipped with silver, he sat with muscular hands folded on a wooden desk that was long overdue for a paint job. The office looked crazily tilted with respect to him and the desk. Even had it had a north wall to serve as a floor, it would have appeared fairly steep now, with the acceleration well on its way toward zero. But this room had never faced squarely north, and so it seemed to lean sideways as well.

The faded pictures of sunsets and seascapes on the "wall" behind Wisniewski did not lean, Jonel noticed; the Director must adjust their suspensions at least every day. Normally

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Jonel would not have been here to notice such things; these days were even more hectic than usual, and he preferred to keep all unnecessary traffic out of the tunnels while the acceleration was changing. But this matter was touchy, so he had come anyway, leaving Sandy to handle anything that came up at headquarters.

"What I really want to know," he asked, tiring of bush-beating, "is whether you've seen any direct evidence of agitation about this within the educational system."

Wisniewski laughed loudly, but just a bit self-consciously. "Well, now, that's sort of hard to say. Campus riots pretty much went out with campuses." He spoke with enough Texas drawl to remind Jonel of the existence of different regions and make him wonder how much life had diverged in them during the decades of isolation.

But he wasn't answering the question. "I was thinking," Jonel said, "more of incendiary material worked into your curricula."

"Oh." Wisniewski looked mildly startled. "None that I've recognized, Mr. Turabian. Certainly none that I've approved or encouraged. Of course, I haven't been able to screen every word of every instructor, but we have tried to be careful and reasonably thorough."

"I see." Jonel watched Wisniewski's face carefully as he considered where to go next.

The wait and the implicit almost-accusation made Wisniewski uneasy. "I can tell you this," he said to fill the void. "I don't think you have to look for deliberate agitators to explain this. Education makes people inquisitive, if it's any good, and most of the population has been primarily students for years. You get that many people doing that much thinking and talking about the trip, and some of them are sure to start wondering how it all started. We've always had questions and speculations about it—the same kind of youthful iconoclasm that's always led some students to think their teachers are old fogeys who don't know the score. They've just gotten a little noisier lately."

"It would be an understatement to call that an understatement. These rumors are so rampant that a lot of people are ready to act on them whether they know or not. Dangerously many people, and it's all happened surprisingly fast. Isn't that true, Mr. Wisniewski?"

"Oh, yes. The question is very hot, all right."

Jonel looked pointedly at him. "Rumors don't usually do that well unless they're encouraged."

"Well, I don't know about that." Wisniewski looked thoughtful. The pictures behind him rattled and flapped with a slight tremor, but neither man paid any attention. They were more than used to such things. "I suppose I agree, but does the encouragement have to be as deliberate and purposeful as you seem to think? Couldn't it just be the pressure that builds up when you herd people into tight quarters and let them think

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about how their whole lives are going to be changed in one swell foop a few weeks from now? It's going to be just like the birth trauma all over again, Mr. Turabian. Except they know it's coming."

"My wife," said Jonel, "compares it to waiting for Christmas morning when she was a little girl."

"But not everybody can see it that way. Especially people who've spent their whole lives on the trip."

"Yeah." Jonel understood that only too well. The reminder could open a whole hornet's nest of memories for either him or Sandy. But he refused to let it.

"Maybe," said Wisniewski, "we should be flattered that our teaching efforts have made so many people start thinking."

"Maybe. But they shouldn't be wasting it on that. Not now." Jonel stood up. "Thanks for your time, Mr. Wisniewski. We may want your help in trying to calm them down. I'll let you know." He started along one of the floor ridges to the door, which here opened "down."

"I must confess," Wisniewski remarked as Jonel steadied himself and opened the door, "I've often wondered myself just what did make our galaxy explode. We teach all the popular scientific theories, once over lightly, but they're all so . . . theoretical." He smiled. "You don't suppose there's any truth in these rumors, do you, Mr. Turabian?"

"Even if I knew," Jonel said flatly as he started down the steep stairs to the corridor, "I wouldn't comment just now."

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Surprisingly, the only call Sandy got while Jonel was out was from Scott, their one surviving son. He was in a gloomy mood and in need of cheering up. Sandy wasn't sure how much help she'd been, but she did know he'd had some of the opposite effect on her. Things he'd said—about the brother and wife he'd lost, among others—coupled with the rare spectacle of a little time on her hands, had set her to thinking about things she'd had virtually no time for in years. She found herself thinking of the whole trip in broad outline, vividly colored here and there by memories of Old Earth and incidents along the way,

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and by thoughts of the promised land that was now so close.

And of all the things that could still go wrong before they got there.

She waited restlessly until Jonel came back, and she cringed at his verdict. "Wisniewski wasn't very helpful," he said, "as far as fixing blame is concerned. But he agrees that the damage is done, and as bad as we thought—though of course he has no idea just how bad that is."

She nodded. "But you think I should tell everybody?"

"I think you'd better."

"I was afraid of that." *But not surprised,* she thought. She considered silently for a few seconds, adjusting her frame of mind to the task. Then she stood up. "I'd better talk to Beldan first."

Over thirty years ago, when it had become clear that his relationship with Earth was to be a permanent one, Beldan had arranged to have a few personal things sent down from the starship that had brought him. Not many—just enough small samples of their exquisite swirled metalwork to make him feel a little more at home. To a human visitor they made his quarters seem slightly alien. To Beldan, the pervasive reminders of man in such basic things as the shape of the room must have made it even more so.

He was visibly apprehensive when he saw Sandy at the door; he knew the Turabians' feelings about unnecessary personal visits. He welcomed her almost as graciously as ever—though with an underlying chill that had been there since the day they chose Clark's World, and still made Sandy ache. But as soon as he had shown her to a big gimbaled chair, he asked quietly, "Is something wrong?"

She nodded slowly. "I'm afraid so. Beldan . . . I'm going to have to tell them how the core explosion started."

His eyes jerked violently. "The truth? That our ancestors did it?"

"I'm afraid so."

He took out his pipe and for half a minute played something quietly frenzied. When he stopped, he said, "I don't understand. Why should that be necessary after all these years? Only four humans have ever known, and two of them are dead. Why can't it remain your secret?" He played a little more, then broke off as if startled by a sudden realization. "Are you doing this because of the difference in our goals for the new planet? I've heard of humans doing things for such reasons, but I never thought you—"

"No," she said quickly, "it's nothing like that. Please forget that, Beldan; I'm trying very hard. That's something we'll have to work out after we're down. Worrying about it now can't accomplish anything."

He nodded very slightly—and stiffly—but said nothing.

"I have to tell them" Sandy said, "because they're dangerously close to figuring it out for themselves. People have been asking questions about how it started, and some of them have

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guessed the right answer and started blabbing it around on the comnet. The questions are getting more and more pointed, and they're pointed at us."

"I see," said Beldan.

Sandy winced—not so much at the suggestion itself, as at the realization that Beldan had become capable of making it. When they'd all been guided by their Coordinator, no Kyyra could understand—much less practice—the deceit or violence long familiar to man. But the Coordinator was dead, and the need to deal constantly with humans was forcing its heirs to learn new ways. *We seem,* she thought, *to be learning each other's worst traits.*

"We've tried," she said. "I don't think we dare try any more. They're too close to knowing, and we're pretty sure the process is being helped by Moses' professional agitators. We suspect they started it, in fact—it may have just been a lucky guess at first, but it's gone far beyond that now. We've noted some censorship—actually caught a couple of speakers—but that just provokes demands for explanations and makes the original question still hotter. They're in an ugly mood. They're demanding to know whether Kyyra did cause the explosion, and we have the choice of trying to weave an ever more intricate web of lies or finding the best way to tell them the truth before they're so sure we have to admit it. If that happens, it'll demolish our credibility, and in the first few years we're going to need all the cooperation we can muster."

"But they have not yet established the truth on their own," Beldan said. "They might not—"

Sandy shook her head vigorously. "Wishful thinking, Beldan. You've learned a lot about people, but still not enough. In the first place, the chances of getting away with it are almost nil. And it doesn't really matter whether they know it's true. If enough of them believe it, the effect will be the same. Bad. For you."

"You mean they'll want to refuse to help us with colonization, and you know how badly we need that help. It's been a *long* time since Kyyra have tried to live on an undeveloped planet." He piped through a brief pause. "But if you actually tell them, that will guarantee that that happens."

"No. My hope is that it will soften the blow. It's going to happen regardless, Beldan. That's so certain you can consider it assured. It's that bad. But if I talk to them before they have us backed into a corner and their fangs sharpened, I can appeal to their better nature. I can emphasize that the explosion was an accident and no living Kyyra had any part in it. I can make it very clear that we're fully committed to helping you in return for what you've done for us. If I do it now, some of them will listen and I can make them understand. It won't stop all the adverse reaction, but it'll help. If I don't do it—you'll get no sympathy. They'll lynch anybody who tries to help you, and they might not even wait till we're down."

For a long while Beldan just played

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or stared blankly into space. Then he said, without looking at Sandy, "I have no alternatives to suggest, so I will trust your judgment. Needless to say, though, I don't like it."

His face showed how inadequately that expressed his feeling, and that intensified Sandy's ache. *And so the rift widens,* she thought. *Just when we need each other most.*

Like Henry Clark before her, Sandy had developed a good feel for what to say to the public, how to say it, and what reactions to expect. Her "confession" and plea for understanding on behalf of the Kyyra brought few surprises. With the fact confirmed, there was a predictably savage outcry against giving them any help after they were down. But it was not as savage as it would have become had things been allowed to continue on their own. And it was balanced, to some degree, by more compassionate voices.

Beldan was less pleased. He saw only that there was now overt agitation against the Kyyra, and that scared him—both because he still couldn't quite understand it, and because it might lead to action. He withdrew even more into himself, talking less to the Turabians and spending more time with his pipe when he had to talk to them. Sandy often wondered uncomfortably what he was thinking but not saying.

In the remaining weeks, the star on the special comnet channel, already far brighter than its background, grew steadily more brilliant, became a visible disk, and grew into something that actually looked like a sun. Eventually it was too big and bright to look at, and the view shifted to Clark's World itself, first just a pinpoint of light, but growing brighter and brighter and then becoming a partial disk.

With it grew Sandy's feeling of Christmas Eve anticipation—but marred by the gathering doubts. The controversy over help for the Kyyra grew steadily hotter; Beldan grew steadily more distant. Sandy could imagine Moses—whatever he looked like—sitting back in some room somewhere, coolly sizing up the opinion trends and calculating how to use them.

And then flitting quickly to another such room, again evading capture and thus adding another notch to his popular glamor.

But neither she nor Jonel had much time to dwell on that, for there were too many practical problems still to be solved. As the time drew near, too many people still remained outside the flight cities, beset by growing panic that they wouldn't be moved in time. That in turn helped Moses undermine trust for the Turabians. Sandy did all she could to combat the panic and distrust and Moses' propaganda; Jonel worked with Zhalāū to make sure everybody was moved and the cities ready to go; Security and Intelligence tried with partial success to anticipate Moses' moves and plan countermoves.

And sometimes Sandy found a few

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seconds to remember just how frightfully tricky that whole untried landing operation sounded.

With only days remaining, the battered remains of Earth slid into parking orbit around Clark's World. There wasn't enough left of Kyere to bother; its remains were simply broken into small pieces, some of which its occupants would ride down while the others were abandoned in space. Sandy somehow found five minutes to watch the blue and white globe on the special comnet channel, while Jon listened and talked on an extra set he'd brought in.

It looks a lot like Earth, she thought, *from way out here.*

And from right down on it? Who knows? We know so little about it, really. And we're going to live there ... all billion of us.

Not a billion, anyway ... but just ... sounds better. A far sad ... than what we started with.

Not very far from what we'd be ... if we hadn't done it, too.

For a moment she thought of the beings already living there. She didn't know what any of them looked like, but she felt a certain sadness for them on the eve of their invasion. For some, she knew, it had already begun. Even at the compromise distance chosen for the parking orbit, Earth would already be increasing and complicating the tides below. It was all too easy to imagine millions of shore organisms drowning in salt water as the seas swept higher than ever before, while marine forms baked and shriveled in the sun below what a month ago had been low-water line.

Her thoughts were jolted away from that by the words that caught her ear from Jonel's transceiver. The voice was unmistakable, and the oratory of unprecedented bluntness. "Your rulers," Moses boomed, "have promised you that we will continue to pour human resources into helping the very aliens who destroyed our galaxy and made all this necessary. But I promise you that we will not. The hour is almost at hand when we, the people's liberators, will take our destinies back from the tyrants and into our own hands. And then, you may be sure, you will get all your due, and they will get theirs—which is nothing."

Though voices of reason could still be found on the comnet, the dominant impression during the next hour was one of bloodthirsty frenzy as caged humans rallied vocally around Moses. Before the hour was out, Beldan was at the Turabians' door, his face blazing with a kind of anger Sandy had never before seen there.

The floor was again the floor, and for all practical purposes horizontal. So Beldan walked in, with a gait that looked as if it wanted to be an enraged stomp, though the feeble gravity turned it into a dreamlike half-float once reserved for men on the Moon. "You've heard this threat of Moses'?" he demanded, his voice reverting to the odd leaps of pitch he had laboriously trained away over the years.

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"Yes," said Sandy.

"And the reactions to it?"

"Yes."

Beldan glared. "What do you intend to do about it?"

"The same things we've been doing," Sandy said tightly. "We've tried repeatedly to talk to Moses; he's pointedly ignored us. You know about the Security and Intelligence efforts against the conspirators, the defense plans to hold them off—"

"What assurance do I have that any of that will succeed?"

"None," Sandy said bitterly. "No more than we do. You have only the knowledge that we're as anxious as you to stop them, and we've done everything we can. But we're not without limitations. We may fail."

"And if that happens—how much chance will we have here?" Beldan started to say something else, but broke off and lifted his pipe to his mouth. For a minute or more he played a long, winding tune that seemed to wander here and there and find nowhere satisfying to go. When he finally stopped playing and spoke, his voice was low and his expression somber. "Many years ago, when you told Henry Clark why we had offered to move the Earth, I told you our offer was good whether you helped us or not. Now that the time has come, I begin to understand that things have changed. Of course, with the Coordinator gone, I suppose I see things differently." Abruptly, he thrust his pipe into its hidden pocket, straightened up, and stared down hard at Sandy. "Perhaps," he said in an altered voice, "your efforts to deal with Moses would be surer of success if you had a stronger incentive to succeed. Perhaps I should remind you that we have things you may need even after we're down. Only we have the ships which will provide easy transport between colony sites. Only we know how to make the converters which enable humans or Kyyra to eat food containing substances they normally find toxic."

"I know that," said Sandy. "I've tried to make people understand—"

"I might also point out that we outnumber you." His eyes narrowed to slits as he said it—a human gesture Sandy had never before seen him use. She shivered. *So now you're threatening us,* she thought, astonished. That, too, would have been unthinkable when he first came to Earth. The Kyyra had not yet lost enough of their old orientation to deal successfully with man on his own terms—they had lost the Coordinator too late and had too little chance to practice—but the time would come.

If they got through the present crisis.

"I understand all that," she said in a voice as cool and level as she could muster. "Jonel and I are as afraid of what can happen as you are. But we can't promise you anything. We're doing all we can."

Beldan looked away, but from the side she could see his eyes jerk back and quiver in their sockets. After a lengthy silence, he said, very low,

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"We also have the pilots." He turned back to stare at her, his gaze suddenly steady and harsh. "Suppose we don't take you down. Suppose we just keep orbiting."

Sandy made her answering gaze as steady as his. "What good would that do? We'd all just die here in space, knowing we threw everything away for a future we could get this close to and still never reach because we were too stubborn."

"We will sacrifice ourselves if necessary," Beldan said. "But that's not the idea, of course. The idea is to broadcast the threat in the hope that it will force Moses to back off, or at least deal reasonably with us."

Sandy shook her head. "Won't work. We're already committed to you, and we have every intention of staying in power long enough to turn things over to people who'll treat you fairly. There's a good chance Moses won't even try his coup until we're down, so any promise he makes now is meaningless. No, Beldan, we have one problem now. Get down. Everything else we work out however we can afterward."

Beldan stared silently for a while, then turned away. "I guess it will have to do," he murmured. "For now."

He left.

Sandy turned to Jonel with a sigh. "So . . . aside from that, how do we stand? Are we going to get most of them moved in time?"

"We'll get them all," said Jonel. "But it'll be tight."

Sandy nodded. "And the local governments into new, secret quarters?"

"Most of them are already moving."

"With good defenses on both those and the pilot stations?"

"As good as we can manage. We'll soon know if that's good enough."

Sandy was silent, thinking over one of the last things she had said to Beldan. "How soon? What do you think, Jonel—are they going to strike before, during, or after?"

"I wish I knew. Not before; I feel pretty sure of that. There's nothing in it for them. But beyond that . . . I can think of two ways they might figure it. One is that they don't dare act during the descent for fear of jeopardizing the flight itself."

"And the other?"

"That it's the best of all times—because we wouldn't dare strike back, for the same reason."

Sandy and Jonel, with Scott and his eight-year-old Karen, were the last to move. The last couple of days brought the hectic preparations to a nerve-wracking climax, and then—with an odd feeling of letdown despite the sinister undercurrents that remained—it was time.

Sandy cast one last glance around the room, ironically reminded of a person leaving home on vacation, back when such things were possible. She laughed nervously. "Are we forgetting anything?"

"I don't think so." Jonel smiled and touched her hand. "Let's go."

We're leaving so much, she

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thought. But she turned out the light—as if it mattered—and pulled the door shut. Scott walked silently beside them, his lean face full of uncertainty, through the short branch tunnel toward their waiting car. Karen bounded ahead of them—footsteps and chatter echoing off the walls, strawberry blonde hair flinging the dim yellow light back in transient sparks—full of the eagerness Sandy kept trying to convince herself she still felt. She thought ruefully of how little time she and Jonel had had to spend with their granddaughter, and was grateful that Karen had so far kept as much zest for life as she had. *She'll take to a new world better than most of her elders,* Sandy thought, *if they'll give her a chance.*

And therein lies such hope as we have.

Jonel opened the door of the tunnel bug and let Karen climb into the back seat, followed by Scott. He and Sandy took the front. It was tight; even with the things of state already sent ahead, personal items that wouldn't fit in the trunk spilled over into the passenger compartment. Jonel tilted the joystick and with a quiet hum the car slid away from the platform and into the Titusville tunnel.

I hope we don't meet anybody, Sandy thought as they sped through the deserted tunnel, occasionally passing a terminal where a dozen public cars sat silent and empty. At every turn she half-feared that the headlight, boring through the blackness and ricocheting off walls, would spot a pedestrian or another moving bug. Then the car would act automatically on the warning that anyone in the tunnels today would be shot on sight—and the victim might well be innocent and unsuspecting. She didn't think she could stand that. She certainly didn't want Karen to see it.

She felt deep relief when Jonel's dizzying succession of sharp turns past flashing junction signs brought them into Titusville. They veered into an unmarked side tunnel, turned twice more, and stopped by a blank door.

"Everybody out," said Jonel. "Briskly."

The room they filed into, through a short vestibule, was of fair size, but none too large to be shared for an extended period by four humans and two Kyyra. It was familiar to Sandy, but not familiar enough. She hadn't made it over for co-pilot training nearly as often as she'd intended. But Jonel had done better, and with any luck even that would prove to have been unnecessary.

Thick green drapes formed the left wall, broken at two points by the ends of thin metal partitions. Much of the right wall was devoted to a big, curved console jammed with tiny controls and indicators, all labeled with Kyyra symbols—except one small English group at the right end. A screen near the middle showed Clark's World. Qabrim sat in a massive and elaborate swivel chair at the center of the console; another, similar but smaller, stood empty next to his. Beldan stood looking over Qabrim's shoulder at

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something on the panel. They were conversing in their own language, but broke off when the humans came in.

There were greetings—painfully stiff and formal—and introductions, since Qabrim did not know Scott and Karen. Those things taken care of, Beldan came right to the point. "We're all here. Is there any reason to delay longer?"

Jonel shook his head. "I can't think of any."

Beldan spoke a few musical syllables to Qabrim. Qabrim replied tersely, then turned his whole attention to the console and touched things. Beldan took his pipe out of his robe and began playing meditatively. *Their tunes have changed,* Sandy observed. *Is it just styles changing with time, or something deeper that came with the loss of the Coordinator? After all these years they're still alien, in a lot of ways.*

Other sounds died out, leaving Beldan's haunting melody alone. Even Karen was quiet, for once, intently watching Qabrim's every move. Sandy tried to picture the unseen changes he was producing—the tunnel through which they had come sealing off, forever shutting off the old spaceport and the entire past to which it belonged.

This should be a joyous occasion, she thought. *I've looked forward to it for more than half my life.*

So why can't I feel more that way?

That was all too easy to answer.

Beldan pulled a cord and the green drapes parted to reveal three alcoves with beds—a slightly undersized double in the middle, opposite the console, a pair of stacked bunks in the left end compartment, a single in the right. He stretched out on that one, gathering several straps to assemble a padded harness around himself. "Better strap in," he said. "There should be no need, but if anything should go wrong, it's most likely to happen near the beginning or end."

Sandy and Jonel lay down side by side on the wide middle bunk, under a low, padded ceiling. As she figured out how to connect her harness, she heard Scott and Karen talking softly in the compartment to her left, trying to reassure each other as Scott made sure Karen was securely strapped in. And she saw Qabrim strapping himself into the padded control seat.

"Thirty seconds," he said. He and Beldan exchanged several of their own syllables. Sandy felt muscles tense throughout her body, and consciously relaxed them.

After a while she imagined she felt a quivering, but it was too faint to be sure. There was no noise; the Kyyra, in defiance of what humans had not long ago considered natural law, were too efficient for that. But under and around Titusville, delicate tendrils of exhaustless annihilation, drawn out from the dying drive reaction under Qabrim's remote control, should be embracing the city, creeping toward the surface, severing it from the Earth and sealing the edge.

And meanwhile lifting gently from

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below, lifting the severed slab skyward while holding it intact and undistorted against all its natural instabilities.

It still made Sandy nervous to think about it. But it was no longer academic. She felt her weight building up, pressing her more and more firmly into the bed. In a few minutes, she estimated that it tripled or quadrupled. That left her still below "normal," but enough above anything in recent memory to be uncomfortable at first. But consciousness of its significance overcame any discomfort. *It means,* she thought with delight, *we're airborn—or whatever I should call it. We must be miles up. Dozens, maybe even hundreds.*

We made it!

So far.

She grinned and squeezed Jonel's hand. He squeezed back. Beldan started piping. Karen asked, "Will we get much heavier?"

"I don't know." Scott's voice was strained.

Qabrim was unfastening his harness. "Not too much, Karen," he said. "I'm easing it up toward what it'll be after we land, but it'll be so gradual you can relax. Walk around or sleep if you like. It'll be hours before anything exciting happens."

I wish I could believe that, Sandy thought wryly as she unstrapped and stood up. But she refused to dwell on it. It felt too good to know they were on their way down.

She poked her head around the end of the partition to see Karen easing herself off the top bunk and onto the ladder with a mildly comical mixture of caution and haste. She grinned at Sandy. "We're really doing it, aren't we? And all the others, too."

"As far as I know." *It must be quite a sight,* Sandy thought. *Five thousand cities rising like a flock of frightened birds from the surface of one planet, to migrate in a few hours to another. Too bad we can't watch.* "How does it feel to have weight?"

"Different." Karen wrinkled her nose slightly as she stepped off the ladder and tried to jump. "I miss being bouncy. And I think I'll get tired at first, even after all that exercise. But I'll get used to it. Just wait till I can go outside every day."

"That's the spirit." Karen went off. Sandy looked down at Scott, still lying on the lower bunk with his eyes closed. "How about you, Scott?"

"I think I'll stay here and rest," he murmured.

She looked at him for quite a while. This depression he'd been in lately was not good. She'd hoped that the excitement of journey's end would snap him out of it.

But she decided not to say any more just now.

Half an hour later, Karen tugged at her sleeve and whispered, "Grandma, can I talk to you a minute? It's Daddy. I'm worried about him."

Sandy sat down with her on the double bed. *So am I,* she thought. "What's the problem?"

"I thought he'd be as excited as I am, but he just lies there and grunts

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when I talk to him. And he yelled at me. What's wrong?"

Hm-m-m. Well, Karen, maybe he's just tired. Things have been pretty hectic lately."

"He didn't act just tired."

"Sometimes it's hard to tell. Remember, this is going to be a big change for him. Most people are a little afraid of change, even if it's supposed to make things better. And they tend to get more afraid as they get older."

"You're older than Daddy."

"True. But I remember Before. He doesn't." Sandy chuckled and lifted the curtain of soft hair away from Karen's ear to whisper, "Besides, don't tell anybody, but I'm a little afraid, too."

"Really?"

"Really. Aren't you?"

Karen studied her grandmother's face with an intent frown for several seconds. Then she broke into a grin with a certain amount of relief in it. "Uh-huh. But don't you tell anybody either."

"My lips are sealed. Now, I'll talk to your Daddy. But don't you worry about him. Okay?"

"Okay."

Sandy stepped around the partition to where Scott still lay, breathing slowly. "Awake?" she asked.

He opened his eyes but didn't look at her. "Uh-huh."

She sat down on the edge of the bunk. "Karen's worried about you. I told her I'd talk to you."

"I heard. Not much privacy."

"True. Are you feeling okay?"

Scott nodded. "Yes. I'm sorry I snapped at her. But she was getting on my nerves." He propped himself up on an elbow and looked at Sandy as if he urgently needed to defend himself. "Look, Mom, I know my attitude hasn't been what you'd like lately. I hope you understand why."

"I think I do."

"I had as much enthusiasm for the trip as anybody when I was young—"

"You're still young, Scott. You're not even thirty."

"I don't feel young. But, okay . . . when I was younger. When I was little. I thought it was something great, then—us and the Kyyra working together to save ourselves from extinction and find a place where we could build lives like you had on Earth Before. Anybody'd feel that, being around you and Dad and Henry and Beldan all the time—"

Well . . . almost anybody, Sandy thought, remembering Greg.

"—but I'm not so sure any more. One thing after another has chipped away at my faith until there's not much left. Forced marriage . . . work draft and cannibal crews . . . Greg . . . Alycia's first miscarriage . . . what finally happened to her just when we thought we had a real marriage . . . all the things going wrong now . . ."

"It's got hard to keep believing—either that we'll succeed, or that it'll be worth it. I've tried to keep up a good front, for Karen. She'll do better if she can start with a positive atti-

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tude. But me? Now that it's happening and there's nothing I can do but wait, I keep thinking about the problems, and she keeps chattering about how great it's going to be. It just got to me."

Sandy reached out to rub his head and shoulders as she'd often done when he had rough moments as a boy. "You've just had too much time to think," she said. "When you get outside and take your future into your own hands, you'll be all right." Her tone shifted slightly. "But you'd better do something about Karen. She's worried about more than you, though she doesn't know it. You're making her afraid there's something about what we're doing that's so scary you're afraid to tell her."

"I'll talk to her." Scott sat up. For a moment he sat silent, a little like Rodin's *Thinker,* but closer to action. Watching him, Sandy became vaguely aware of an extra voice out in the main room, but it didn't quite register.

Until Jonel glanced her way and said, "Better come out here, Sandy. Somebody on the radio wants to talk to both of us."

She straightened up abruptly. Now she recognized the voice.

Moses was making his move.

"The time," the too-familiar baritone said smoothly, "is at hand. By the time we're on the ground, control will be out of your hands and safely in ours. It will go easier for everybody if you cooperate now. And encourage everyone under you to do the same."

He paused. When neither Jonel nor Sandy said anything, he resumed just as smoothly. "At this moment, our agents are within minutes of seizing each of the landing cities. I strongly urge every government to surrender now, so violence will not be necessary. Needless to say, that includes you in Titusville."

Sandy checked an indicator on the government communication set at the end of the main console. The transmission was not scrambled. They would have to assume everyone on Earth was listening.

"Your claim seems a bit premature," Jonel said evenly. "You mean your agents are within minutes of *trying* to seize the cities. That's not the same as success. We anticipated this, of course. The cities are prepared to defend themselves." If Moses thought they wouldn't try, he had misjudged. An inflight attack was one possibility they had definitely anticipated, and plans were ready for it. But they would be limited in what they could do . . .

"Need I point out," said Moses, "that we are at a rather critical stage of things? Any attempt to resist will pose a threat to safe descent and landing—and lives. Is that what you want? More slaughter of the people you claim to protect?"

"Evidently it's what you want," said Jonel. "No resistance will be necessary unless you strike first. It hardly seems necessary to point out that the one sure way to avoid those

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risks as for you to call off your dogs before they bite anybody."

"Unfortunately, that also means passing up our one good chance to make sure we end your so-called emergency rule. No, Mr. Turabian, we can't afford that. So the responsibility for safety must be yours. You've said repeatedly that you plan to abdicate once we're down. Why not do it now?"

"We didn't say," said Sandy, "we'd hand it over to a new dictator."

"That's harsh, Mrs. Turabian. I don't intend to keep it. All I want to do is give it back to the people."

"We know that's what we mean to do. We don't know about you."

"I could have said the same thing," said Moses. "Interesting, isn't it, that we both say we want the same thing, but neither of us dares trust the other. Tell me, can you give us some proof? Some sign of good faith that will let us feel really confident that you mean what you say?"

"Can you?"

"Stalemate. So we fall back on the old historical standby—brute force. How gauche."

"You don't have to," said Jonel. "If you really care as much as you say about people, you won't."

"And we don't both want the same things," Sandy added. "How about the Kyyra aid question? If your intentions are so good, why have you paved your way by appealing to the worst side of people? At least we haven't done that."

"Haven't you?" Moses asked quietly, and Sandy cringed. She was almost relieved when he went on, more rapidly, "We're wasting time. You had your chance, Mr. and Mrs. Turabian. Whatever happens now is on your hands. It's a pity you're willing to jeopardize the cities. But so be it. I'll see you soon."

"Our guards," said Jonel, "are ready for you. And remember that anything that jeopardizes Titusville jeopardizes you and your plans as well."

"Your guards," said Moses, "are some of us. I repeat, we'll see you soon." A tiny light went out on the panel, showing that Moses' carrier wave had vanished. The call was over.

Sandy looked at Jonel, and at Karen, standing with a worried look by the foot of Scott's bed. "Do you think," she almost whispered, "that could be true about our guards?"

Jonel shrugged. "It's not impossible. We'll find out soon enough, I suspect."

That particular possibility seemed increasingly remote as hours went by without visitors. But there was no shortage of tension. Not only the nagging uncertainty of when Moses would strike and with what result, but many things—the frantic preparations, the early rising for the trip to Titusville, the steady tug of almost a full gee, the problems between humans and Kyyra—all had taken their toll. Everyone was edgy. Beldan had

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withdrawn so far he spoke only such few words as he must. Scott was not much better, though for different reasons. Karen didn't become quiet, but she did become wary of irritating the others, and her cheerful anticipation was increasingly eroded by nervous apprehension.

It was just as well that the same things which made people jumpy had also made them tired. The trip down would last many hours, so everyone—except Qabrim—tried to sleep, and often only one or two were up at a time. It bothered Sandy that Qabrim had to stay awake and at the helm for the whole time, but neither she nor Jonel had learned enough to try replacing him. Even tired, he would do far better.

For her, the hours passed in a fitful alternation of catnaps and pacing, algae snacks and screen-watching. Always, when she woke, she went first to stand beside Qabrim or sit in the co-pilot's chair and look at the view, watching the disk grow until it overflowed the screen and gave way to details like continents and seas. Between those times, as she tried to sleep, there was a tossing, shifting, unceasing procession of dreams and half-dreams. The dreams were full of openness and freedom, of bright blues and wispy clouds and feathery breezes. There was more of the Christmas Eve imagery, and occasional snatches of the "Songs of Old and New Earth" she had long ago written and sung for Scott and Greg.

And all of it harshly tempered by the impending threat. As the hours went by, there was less sleeping and more pacing as unnerving reports came in to emphasize that Moses wasn't bluffing. The first three calls came less than an hour after his call to Titusville. They were not distress calls, exactly—Ahmadabad and Bratislava and Lusaka couldn't possibly have expected anybody to come to their aid. They merely told the world they were under attack, and the nature of the broadcasts was such that the whole, chillingly swift takeover was heard in real time.

Such reports came more and more frequently. The raiders were not always successful; a fair number of cities eliminated them. But too many did not. And some did even worse. The one that really shook Sandy and Jonel was Krung Thep.

"Guerrillas have penetrated the control center," a voice said in thickly accented English. "They're scuffling—"

Noises: steps, furniture, voices speaking agitated Thai, explosive sounds, two shrieks . . .

The original voice, becoming shrill: "The pilot's unconscious. There's no one at the controls!"

Beldan leaned on the console as if stunned. Sandy's skin tingled. Karen stared with wide eyes. "What'll happen to them?" she whispered.

Qabrim twiddled something on a remote part of his panel. His face twisted into a Kyyra expression that Sandy thought was related to a frown. "They're close to the ground . . .

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going down fast . . . nobody's doing anything . . ."

"Can't you help?"

"No. I have all I can handle here, and no connection to them." He stared intently at the panel. "They're spinning . . ."

The next five minutes were agony. A couple of other reports intervened, but Sandy hardly heard them. But she heard Qabrim when he looked suddenly down and murmured, "They've hit. The quake must have been considerable. I can't imagine any survivors."

He and Beldan let their faces go alien and began to pipe. Sandy lay down on her cot, feeling sick.

It wasn't long before Kiev reported that it was surrendering without a struggle. "Nothing," its spokesman said, "can be worth another Krung Thep. We surrender. We implore the world government to do the same, and make surrender the policy for all governments to follow . . ."

Jonel looked at Sandy. "We can't do it, of course."

"Can't we?" She pondered, more doubtful than she could imagined herself a few hours ago. "No, we can't." But her voice sounded weak in her own ears.

There were other Krung Theps—at least three or four—and there were other Kievs. The decision was not easy. Sandy preferred to leave this one mostly to Jonel—but they held out. Cities would still use their own judgment about when, if at all, to surrender. For Titusville it would be an extreme last resort.

Sandy was lying down next to Jonel, with the end getting near and the horizon on the screen almost straight, when the buffeting started. Not a regular quake like the ones everyone was used to, but a faint, irregular series of bumps that seemed to come from outside. She fought down the urge to sit suddenly upright. "What's that, Qabrim?"

"Only a little turbulence. We're getting down into the atmosphere. I'd suggest strapping in for the rest of the trip. I'm broadcasting a warning." He had already followed his own advice, and was now putting on a rugged helmet that almost matched his smooth head.

He must think it could get pretty rough. Sandy thought as she reassembled her harness. *Well, I guess it should. Even if it wasn't before we got here, we ought to stir it up a bit.*

The significance of Qabrim's key word washed over her in a sudden refreshing flood, momentarily sweeping everything else away. Her face broke into the first broad smile of pure exhilaration she could remember in many months.

Atmosphere. Air. That buffeting meant it was really out there—the sky, the breezes, the chance for some semblance of the life she and Jonel had been planning over half a lifetime ago and had to defer until now.

And now it was coming. Christmas morning was actually coming.

She looked at the clock over the console.

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Only three more hours.

Three hours is a long time to be strapped in. For most of the first two, the turbulence wasn't too bad. Several times Karen whined that she didn't need to be strapped down, and tried to wheedle permission to get up. Each time Scott convinced her she mustn't, though he was obviously not very convinced himself. They grew audibly jumpier as the hours crept by. But a city does not fly gracefully, even with Kyyra technology, and the process could not be hurried.

By the end of the second hour, nobody was asking to get up. It grew so rough near the ground that Sandy found herself clinching her fists and gasping with some of the more startling jolts. *Did they know it would be this bad?* she wondered. But she didn't ask. From behind, at least, Qabrim seemed content. She wished she could see his face, and the screen that by now must show hills and valleys skimming by not far below.

And still Moses did not come.

The warning voice broke quite suddenly from the comset. "They're here," it squawked curtly, barely recognizable as Murdoch, commander of the guards outside. "Looks like six or seven—"

His voice choked off abruptly in a confused burst of muffled shots and shouts. Sandy's whole body stiffened; her hand and Jonel's found each other at the same instant and held tight. Karen whimpered, "What do we—"

But there was no time to answer, or even to finish, for the activity on the radio had already collapsed into silence. Hurried footsteps sounded outside and, with a crash, the door flew open. Two men strode in.

And everyone inside was still strapped down and vulnerable.

The newcomers lurched and staggered with the pitching of the room. The one in front, a redhead as chunky as the gun he held, looked about twenty-five, but even more prematurely aged than Scott. His eyes darted nervously around the room. Sandy lay very still. The other man, skinny and with dishwater-blonde hair starting to gray and restricted almost entirely to his temples, was older and more self-assured.

The redhead yelled, "Nobody move!"

The graying blonde looked unhurriedly around, somehow maintaining an air of confidence despite his undignified struggle to stay on his feet. "He's right, you know," he said with a slight smile, "even if his manners are a bit unrefined. This is my colleague, Griffith. I am Moses."

He finished surveying the room under Griffith's protective eye, and sat down in the co-pilot's chair and strapped in. "That's better." He swiveled around to scan the bunks. "You'd better strap in, too, Griffith. There. Next to Mrs. Turabian."

"You can't," Sandy hissed. "That's taken."

"An odd claim for one in your position to make," Moses smiled. "It can easily be vacated—"

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"It's all right, Sandy." Jonel unstrapped and stood up. "Don't argue with them." Griffith edged past him and lay down next to Sandy, his gun never wavering. Jonel sat down on the floor next to Sandy's side of the bed, bracing himself between it and the wall.

"I apologize for the inconvenience," Moses said, "but there aren't enough places. Forces us to make priority decisions. Obviously Griffith and I need protection; we can't risk key members of the new government before it's even well established. We can't gamble with the aliens; we need them to get us down. And I have an old-fashioned regard for women and children. Don't worry, Mrs. Turabian. Your husband can take care of himself."

Qabrim faced Moses with a mixture of humanly recognizable contempt and something chillingly alien. "But I can't do my job with you sitting there."

"Oh, yes, you can. And I want to keep an eye on you to make sure. I stay right here."

Beldan's voice came abruptly from his bunk. "No. Let me remind you who has whom over a barrel, Moses. You two have one minute to get out of this room, Moses. Or we don't go down."

"What?"

Qabrim started to say something and Beldan cut him off roughly with a quick burst in Kyyra. Sandy frowned. "But, Beldan—"

"I've thought it over, Sandy. If the alternative is to let—"

Qabrim tried again; Beldan cut him off even more savagely. Sandy began to fear that he wasn't bluffing. "But it's not worth—"

"On the contrary. The price is really surprisingly small—"

Quite abruptly, the buffeting became much more violent. Incoherent noises came from Scott and Karen; Jonel bounced and grunted. Sandy felt her body strain upward against the harness, then suddenly downward into the bed. She felt a sudden chill as she saw that Qabrim no longer looked calm. He, too, was tossed about in his seat, straining at his straps. His hands darted rapidly over the controls. "Qabrim," she made herself ask, "is—"

"Squall line," he spat out, stretching across the panel. He spouted Kyyra at Beldan; Beldan replied the same way. Several fast exchanges shot between them.

"You'll speak English in here!" Moses ordered. "None of that—"

Qabrim turned just enough to glare at him. "You want down in one piece? Then we'll talk how we talk best. There isn't time for anything else." He switched his speech back to Kyyra and his whole attention back to the console.

But too late. The room lurched with a new kind of violence. Things shook; an odd sound between a groan and a rumble came from somewhere outside. Three or four shocks hit in rapid succession. Qabrim yelped something frantic in his own language. His hands darted toward widely separated parts

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of the panel, twisting things violently.

Part of Sandy knew, even then, but she asked reflexively. "What—"

"Separation." He didn't wait for the whole question. "Thunderstorms can be violent, too. And this fool distracted me. We've lost a piece . . ." His arms and fingers writhed; his voice rose tightly. "I don't know if I can handle it."

Jonel was already trying to stand up, but the room was pitching so he lost his balance and hurtled across the room. He caught himself with outstretched arms and fell loosely. He didn't try to stand up. He crawled to the console and pulled himself up to his knees. "Do you move or do I sit on your lap?" he grunted to Moses.

"Sit," Moses grunted back. Jonel did.

Qabrim quickly traced an outline on the panel. "This group," he said. Then, with obvious relief, he gave his full attention to another set.

For a few seconds Jonel tried to work that way, but the position quickly proved too awkward. He stood up, carefully and precariously, swaying like a sailor in a storm. Planting his feet wide and bracing one leg against the console and one against Moses, he managed to stay upright as his fingers played over the controls.

But not easily, Sandy noted tensely. *And he's favoring one leg. Did he hurt it when he fell?*

If he can hold out till we're past the storms . . .

For a few seconds, the violence lessened slightly. Then, as if it had been gathering force, came a blow that seemed to momentarily upend the whole room. Suddenly Jonel's feet were not on the floor. He was flipped into the air, back down, his head swung so far back that Sandy caught an inverted glimpse of his startled face as he flew toward the partition at her left. For a sickening instant, she heard a sound like knuckles cracking. But that hardly had time to register before his head hit the partition, hard, and he dropped limply to the floor. Beyond the partition, she heard Karen's rising wail: *"Grandpa!"*

And then sobs.

The important part of Sandy felt the same way. But the part that was momentarily in charge had no time for that. Jonel had hardly hit the still-tossing floor before she was out of her harness and rolling off the bed. She had better luck than Jonel in crawling to the console; she tried not to look at the blood trickling from his head as she passed him.

"What do I do?" she asked as she pulled herself up at the console. Qabrim showed her. She did it. It was even harder than she'd expected, but with her whole being focused on the task, she managed. Gradually, during an eternity that the clock called four minutes, the battering subsided. Not completely, but back to levels they had lived with before they hit the squall line.

Qabrim relaxed very slightly. "You'd better strap in, Mrs. Turabian."

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"Can you do it alone?" she asked, concentrating on an indicator dot that kept wanting to spiral outward. "Or am I actually helping?"

"You're helping. But—"

"Then I stay." Sandy concentrated grimly on holding her indicators somewhere near center. She heard Scott moving around behind her, where Jonel lay, but she didn't look back. She did allow herself one glance at the screen, showing a fluffy plain of what looked like treetops sliding along just below them, almost a blur, but slowing. She looked back at her controls. Her fingers tried to shake, but she couldn't allow that. "Better strap in, Scott."

"But—"

"I don't want to hear it. If you can do anything in fifteen seconds, do it. Otherwise strap in."

He didn't speak. But he moved back to his bunk in much less than fifteen seconds.

The steady motion in the screen had almost stopped, but the image wobbled. The turbulence grew worse again, and the controls harder to handle.

"Very little drive left," Qabrim explained brusquely. "Has to end just as we touch down, so it doesn't spread into what we land on—"

And then came the first impact, hard enough to throw Sandy to the floor. "Don't try to get up," Qabrim snapped. His hands flew over the console as the whole room shook convulsively. Sandy obeyed, lying flat on her stomach and shielding her head with her arms. The shaking continued for many seconds as the bottom of Titusville flattened several square miles of alien forest and adjusted itself to the irregularities of the ground beneath. A series of sharp shocks sent pieces of ceiling and wall crashing down, but no large ones hit Sandy.

And then, with a final apologetic shudder, the trip was over.

In the hush that followed, Sandy went limp, finally able to admit she was exhausted. *We're down,* she thought, dazed, but she didn't really make the connection with reality until she heard Qabrim say, "Well done, Mrs. Turabian. We've arrived."

She opened her eyes to look across the floor at Jonel, still lying motionless, and everything she hadn't been able to let herself feel before came welling up. With hot, wet eyes she looked questioningly up at Scott, who was unstrapping himself with a blankly grim expression.

"I couldn't do anything," he said.

She nodded dully and crawled to Jonel, allowing herself a minute to convince herself it was true, and to think the farewell she was too late to deliver.

A shadow moved across the floor and steps came alongside her. Moses knelt next to her, his face pale and somber, as if this one incident had for the first time shown him the tragic side of what he was doing. "I'm sorry it had to turn out this way, Mrs. Turabian," he said, very quietly. "But I saw no alternative. When you de-

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clined either to surrender or to provide convincing assurance—"

"Shut up," she said acidly, turning on him. "You have a good tongue, but—"

"Please, Mrs. Turabian." He closed his eyes. "This is painful enough without that. My intentions were completely honorable. It's unfortunate—"

"There's nothing more dangerous than good intentions in bad hands. It's painful for you, you say? You want sympathy from me? You should have thought of that before. A long time before." She glared at him. "So just what have you won? Titusville."

He drew himself up, rebuffed, reasserting himself. "No, Mrs. Turabian—much more than Titusville. Everything. You must have heard reports on the way down. We have most of the cities. The others are just a matter of time."

She shrugged. "So somebody has each city. But how do you propose to bind them together? How are you going to administer it all? Except for the other chunk of Titusville, the nearest human city is ninety miles off. There's a Kyyra site a little closer—only eighty miles. Those distances are typical. All across untouched, unexplored wilderness. No roads, no maps, no airports or planes or railroads. And just full of animals and hazards you know nothing about. How are you going to control even the next city, much less all of them?"

"We're already linked by radio, of course. And after—"

"Hah! So you can give orders. But what's to make them obey, once they realize you have no way to enforce them? You can't slap knuckles by radio, and you can't govern without slapping knuckles. Gradually—and it won't take long—your puppets will drift away and become free agents. And there won't be a thing you can do about it."

Moses smiled and sneered in one motion. "No way to enforce? Come, Mrs. Turabian, let's not be naive. Why do you think I personally took Titusville? Because this is now the center of the world government which has always tied it all together. And—"

"And you plan to use our administrative machinery? Of course, Moses. We've always known that. But we've also known it doesn't exist."

For the first time, his face registered shock. "What?"

"It doesn't exist. It did, when we were on Earth. But it depended on the communication and transportation systems we'd built there. Clark's World is as unexplored and roadless for us as it is for you. For all practical purposes, every town is on its own now—especially if you keep what you've taken."

"But . . . You're lying. All your threats about how you would deal with takeover attempts—"

"Propaganda. I'm not lying now, but we were then. Because we knew you—and others—were listening."

"But it wasn't just what you said. Our spies captured detailed plans, things never intended for public consumption—"

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"But planted. We knew you were a tough audience, Moses. We had to make the show worthy of you."

He studied her face as if trying to convince himself she was serious. Finally he said, "But if that's true—why did you struggle at all? It would have been so much simpler—"

"To voluntarily let your puppets take over from well-established and experienced governments? To let you treat the Kyyra the unspeakable way you've promised?" She paused. "And it's not quite true that there was no way to get goods and services from one site to another. We would have had a network. A weak one, but better than nothing."

His anger flared. "Make up your mind, Mrs. Turabian. Is there a network or isn't there? And if there is, why can't we use it?"

"The Kyyra have ships and shuttles," she said quietly. "Not many, but some. That's all there is. And they won't deal with you—or vice versa."

Moses shifted his gaze to Beldan. With obvious effort, he squeezed distaste out of his face, leaving nothing. "Suppose," he said tightly, "I could find a way to modify my stand on aid. Isn't it conceivable that you could—"

"No," said Beldan. "Never with you. With Sandy, gladly." He started to play his pipe.

"Then we'll make it on our own," Moses muttered. "We're a tough breed, now, those of us who've made it this far." His voice rose furiously, aimed at Beldan. "And we'll see that you get no help, just as I promised. Nothing. Not even the pilots you were counting on to go back as teachers."

Beldan's eyes jerked. Sandy, though appalled by the threat, asked quietly, "What reason could you possibly have for that except personal vindictiveness? Is that one of your honorable intentions, Moses?"

He forced a smile. "I'm honor-bound, Mrs. Turabian. I promised no help for the Kyyra. I have to keep my promises, don't I?" His expression changed abruptly. "And yes, there's a personal element, too. If it hadn't been for them, we'd never have had to destroy our own planet and leave our own galaxy. I could have had a normal life. And I'm just old enough, Mrs. Turabian, that I do remember a little of Old Earth."

"But it wasn't them," Sandy said. "It was their ancestors. You can't blame them for what their ancestors did. The ones we know—if it hadn't been for them, you wouldn't be alive now. Doesn't that count for anything?"

"They owed us that. Now their debt's paid and we're even. A race that can do something like that is never to be trusted again. They're lucky that withholding help is all we're doing."

"I think you'll reconsider even that. I won't waste any more time talking ethics to you. But I know you care about self-preservation. Remember those miles? Sometimes, to keep alive, we're going to *have* to get from one place to another. Some of the things growing out there are food, and some

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are poison. Do you know which are which? The Kyyra have ships and food converters. If we ever hope to use them, we're going to need their good will. Our one-way dependence on them may be over, Moses, but our *mutual* dependence is just beginning. You lay a hand on even one Kyyra pilot, and you'll regret it to your dying day—which may be a lot sooner than you'd planned."

Moses was shaking visibly now, and his face looked as if he had something bitter in his mouth that he couldn't spit out. For almost a minute he pondered the hollowness of his victory before he said sullenly, "I may try to keep that option open. Just in case."

Sandy relaxed slightly. "A wise choice. And while you're keeping options open—I'm here if you need me. Meanwhile . . . you claim to be a humane man. I've come all the way here to see a new world, and I don't see anything else I can do in here. Are you going to let me go outside and look?"

He considered for quite a while, and it struck Sandy that he looked as drained as she felt. "You can go," he said at last. "Griffith, you go along. No need to stay too close, but keep an eye on her."

The light was almost blinding at first; it had been years since she'd seen so much. As soon as she emerged from the tunnel she stood very straight to breathe deeply and look all around. A few other people had already come out, but she hardly noticed them. There was too much else to see and hear and smell.

And feel.

The break was not far away. She scrambled across the jumbled gray and brown ground and in half a minute stood at the edge of a not quite sheer drop. The landing had shattered the weakened edge so that it now fell away as a steep boulder slope—not quite too steep to climb—to the level forest a few hundred feet below.

A few miles to the southeast, with snowcapped mountains far beyond it, the other piece of Titusville stood as an isolated, barren plateau. Sandy felt an abrupt, odd pang of sorrow for the native things that had been crushed by the landing cities. *We'll be gentler, later,* she told them silently. *I hope.*

She sat down on the warm ground at the edge to pull herself together and drink in the reality of being on a planet. Warm, light breezes caressed first one cheek and then the other. Soft sounds drifted up from below, of wind in foliage and uncounted kinds of unfamiliar animal life. She looked down at the green carpet—not quite any green she knew, but lush and richly textured in the late afternoon light—and saw that some of the animals had been attracted to the base of the slab and were prowling around it, looking up. She couldn't tell much about their shapes, but several looked more than large enough to be potentially dangerous. But they showed no inclination to climb up, so she dismissed them as an immediate threat. She closed her eyes, listening to their

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distant hoots and whistles and breathing in the smells.

Most were unfamiliar, but pervading them all, to her surprise and delight, was the same clean smell of approaching rain she remembered from Old Earth. Smells are strange things, seldom remembered as consciously as sights and sounds, but if they ever recur, evoking associations as no other sense can. This one brought back an overwhelming flood of vivid memories of times spent in mountains and woods and shores in a faraway galaxy. For a moment Sandy let those wash over her, savoring them. Then she opened her eyes again to the new reality of Clark's World.

Is it wrong, she asked herself, *to be overjoyed at the same time I'm afraid and more grief-stricken than I've ever been before? I don't think so. Jonel would understand.*

It's going to rain, she thought suddenly. *How soon?* A few dark cloud shadows drifted over the green, but mostly the sky overhead was clear turquoise. But off to the west, and seemingly stretching out over the blue-gray sea to the south, she saw the line of storms that had killed Jonel. The big gray cloud masses were moving this way with visible speed, and the nearest were not far off. A soft, lazy roll of thunder drifted to her ears.

She stood up. Two big leathery-winged things, emerald green with iridescent purple splotches, swooped close, circled with wild giggles faintly suggestive of bass loons, and flew off. A drab crescent "moon," the corpse of Earth, peeked fleetingly through a hole in the clouds.

Two voices, thin in the open air, called her name.

"Mom!"

"Grandma!"

She looked to see Scott and Karen coming toward her from the tunnel exit. Scott's face was nearly blank; Karen was uncharacteristically quiet, but wide-eyed. They said few words, of no particular import. For a few minutes the three of them huddled together as Scott and Karen drank in new sensations. Then Karen asked Scott, "Can I look around a little?"

"Okay," he said. "But don't go far, and don't get too close to the edge."

He sat down on a hummock, and Sandy on another next to him, gazing into herself and out to the west. In those few minutes, the gray clouds had claimed more of the sky, blotting out the dead Earth and the new sun. Thunder rolled around the horizon, closer than before, but weaker, as if the storms were running out of steam. After a while Scott asked quietly, "Well, Mom, do you still think it was worth it?"

She still heard the bitterness in his voice, and it hurt. But the urge to lash out at him lasted less than a second. *He'll be all right,* she reminded herself. "How can you doubt it?" she asked gently, and she answered herself before he could. *To him, this is all new and frightening. All that it means to me, it doesn't to him. Yet.*

"Greg," he said tonelessly. "Alycia.

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Dad. Moses. The Kyyra. Need I go on?"

"No." She looked at him. Her voice became less gentle. "You maybe thought all our problems would magically be over when we got here? Problems are never over, Scott—but people cut down the ones they can and build lives among the rest. Everything you say is true, and it's just the beginning. There'll be anarchy at first, and petty tyrants and civil wars, and famines and winters and droughts and stupid, fatal mistakes. And guilt. Nothing will ever wipe out the fact that we wiped out billions of human lives and uncountable nonhuman ones coming here, that we destroyed a planet's whole ecology more than a decade before it had to die. Nothing will ever make that right or good."

She thought of a dolphin she had once been privileged to know, and had to wait before she could continue. "But if we hadn't done that, it all would have died anyway. All of it—not just almost all. We wouldn't be here. We *are* here, Scott, and that's what's going to count in the long run. We kept some of Earth's life going, and there's no reason for it to stop now. The problems we have now are trifles; they're things people have been living with since people began. But never before have they had to look straight in the face of sure death for everything on Earth and say, 'We won't accept it. Some of us are going to keep going and rebuild something worth having, even if we have to go two million light-years to do it.' That's what we've done, Scott. And you wonder if it was worthwhile?"

He looked at her for a long time, as if he'd just seen something incredible in her face that he'd never before realized was there. Finally he said, "You really believe in it, don't you? Even now."

She nodded stiffly. "Somebody has to. The future's there, if we want it enough." She paused, pondered briefly, and added, "It always is."

He didn't say anything else. He sat pensively for a few more minutes, then stood up silently, motioned to Karen, and escorted her slowly back to the tunnel. But Sandy knew they'd be back.

She stretched, relaxed, looked out and up, slowly regaining a kind of peace she had not known for decades—a peace that was seriously marred, for her, only by the fact that Jonel was not here to share it. "You'd like it," she whispered, as if he could hear. "It's beautiful."

The storm was catching up with them. The dark gray now covered the sky, the air had cooled, and it was starting to sprinkle in big round drops that splattered on and around her, mingling with her tears and washing them away.

For a moment she was almost disappointed. She'd wanted to watch the sunset.

But there'd be plenty of nights for sunsets. For now, raindrops were all she could want. ■

This ends the "Fugitive Earth" series.

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the TANK and its wife

Modern technology makes the definition of death an extremely difficult proposition

ARSEN DARNAY

DOUG BEEKMAN

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The tank drove around the mansion's curving drive passing between lavish flower beds. It was a small tank, painted in random green-beige-yellow patches—a vehicle perfect for the quick and darting guerilla warfare of the African plains.

But this wasn't Africa. The pretentious mansion—a mixture of temple and hacienda—topped a California hill. It was enthroned in near-empty landscape, far from affluent neighbors spotted on other hills. The sun lay bright on rolling lawns. Sprinklers spurted brilliantly. There would surely be a pool in the back, turquoise in the sun; and stables down the hill; and a gardener who rode a wheeled fortress with automatic transmission to mow the placid acres of green.

The tank made a fearful noise. It had no muffler, and the rapid bleh-bleh-bleh explosions of its engine drowned out the clattering, chainy, metallic clicking of its tracks.

Long before the muzzle of its gun had come into view over the steep approach, the lady of the house, attracted by the racket, had run to a bay window to peer out through gauze curtains.

She stood there still, mesmerized and puzzled, when the tank suddenly wheeled at the apex of the drive and, with treads churning newly planted bulbs in dark, moist dirt on either side of the entrance apron, it crashed with a deafening roar and a turmoil of splintering, cracking, tearing, and crunching noises through the portals into the foyer and then into the spacious living room.

The tank seemed to pause. Then its turret swung from left to right, swept a chandelier against the ceiling, pulverizing it in the process. At last it faced the lady of the house. She screamed, unheard, and stood now pressed hard against the window, her hands half covering her face, her eyes frozen in terror.

A panel opened in the turret. A black barrel looked out, then briefly rattled. A string of bullets tore into a wall demolishing two glass-framed watercolors showing Parisian scenes. The pattern of the bullets spelled a message. *Hi,* it said.

The woman ran out, sobbing and frantic, stumbling over the dusty rubble and the chewed-up carpeting behind the tank. She ran down a hallway floored in colorful terazzo, through a paneled room with antlers and bookshelves, through a spacious, glittering kitchen bright with copper pots hung from wooden pegs, and out to a glass-roofed patio.

She raced on from there, past the swimming pool, down the steep lawn, toward the stables. She screamed "Herman! Herman!"—but the gardener was nowhere to be seen, and she began to sob at her own ineffectualness.

The tank came behind her. She heard it roar and glimpsed over her shoulder the white dust it caused to boil out of the house.

The tank emerged through an opening wider by far than the sliding glass door it pushed before it, frame and all,

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ground to dust under its tracks on the irregular, gray slate of the patio.

The tank stopped and appeared to survey the scene. Then its gun fired with a roar, causing the tank to rock back on its treads. Three shells arched over the diminishing form of the lady. They raised geysers of dirt into the air before her. Spent steel fell at her feet. Her ears buzzed with the explosions.

She turned, unthinking, and saw the tank. It stood half covered by the wire-reinforced glass roof of the patio. A stream of fire spurted from an aperture in its turret and fell to the sloping grass beyond the pool. Black smoke boiled from the lawn, spent itself, and left a scorched pattern of words: *Darling Wait I Am Home*.

The lady's face worked out of control. She had mascara around her raised middle-aged eyes. Her lashes had been lengthened, her face carefully made up, her lips accentuated by a pale pearl lipstick. Now her usually cool smooth features were those of a terrified child. She covered her face, collapsed slowly, assumed a fetal posture, and began to rock.

The sergeant was hysterical—a state he frequently experienced. He appeared to be jumping up and down, quivering with impatience, while two kneeling soldiers in fatigues connected the grayed copper ends of a cable to an oblong box with instruments on its face. The cable hung in a loose spiral from a frame just beneath the blinding, neon-lighted, corrugated roof of the hangar.

"Come on, come on! What does it say?"

The men were busy and said nothing.

The sergeant rang his pudgy hands. He sucked air between his clenched teeth and looked entreatingly up at the roof as if to invoke the Almighty's aid.

One of the soldiers turned his head. "The line's dead," he said. "No stimulation coming through at all."

"You sure?"

The sergeant turned abruptly and ran between two rows of tanks. He was a pear-shaped man, unaccustomed to running; his fattish rears danced back and forth; his ankles turned inward. His eyes swept the tanks as he ran—each camouflage-colored and linked by coiling cable to the central stimulator mounted under the roof. They looked peaceful and harmless in the huge, echoing hangar—ninety-nine identical tanks in four rows. Only one was missing, *T98*, midway in the third row.

The sergeant ran toward a half-open door through which could be seen part of a coffee urn set on a typewriter table and next to it white cups that bore the colorful heraldic emblem of the PFP command.

He stopped at the door and looked with still fresh horror at a monstrous, jagged hole in the hangar's metal wall through which *T98* had made its exit during the night. And he looked beyond the gash, across a tread-marked expanse of gravel, at the ruination of the chain-link fence. It

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resembled a basketball basket laid on its side.

"Sweet Jesus," the sergeant muttered and then ran on imagining the track of rubble, twisted metal, fleeing civilians, and burning houses that *T98* could well have left behind.

He arrived at his office, panting, and reached across his desk for the telephone speaker laid on a heavily-doodled calendar blotter. Captain Richards had been holding. The sergeant told him what the instruments had said.

Captain Richards called Colonel Baxter; Baxter called General Hals; and General Hals went to a sleek blue-and-cream computer console against the window of his office and typed *T98* on the keyboard. The machine began to clatter almost instantly.

Hals first skimmed a brief precis of the long report.

"Subject, John Hamilton," he read, "entered PFP program 6-9-85 aged 56 after stroke/paralysis. Background career real estate, well to do. No children or surviving siblings. Politically right of center. Application filed by wife (radio ad response) who described subject 'living vegetable better dead than alive' and executed battery of release forms subject's stead. Wife was told (oral/written) probability subject's survival 2.9 percent. Was notified 12-2-86 subject 'succumbed complications nervous system transplant operation.' Funeral held using actual body, latter displayed wake for friends/associates. Subject enrolled Tank Corps 12-19-86. Performance undistinguished. Scheduled African Theater 5-5-87."

General Hals began to read the meat around this skeleton, but he didn't get very far. Reports began pouring in and he knew he had a crisis on his hands. He ordered his helicopter to be brought around, armed himself with a lacquered swagger stick on whose end a gilded bullet gleamed, and took off to supervise the capture operation from the air.

By the time the general arrived above the scene, hovering in the sun in his bright sphere, the chopper blades a smokey halo above the bubble—the hilltop mansion was under siege. Military forces, sheriff's deputies, two fire companies, and the highway patrol were on the spot.

A crowd of gawkers had also gathered, among them two reporters demanding to know who was in charge. General Hals told Captain Richards to stall the press a little, and this the captain undertook to do. He strode from his jeep toward the pesty reporters with a stiff, forbidding curl about his lips; but he had flutters in his stomach.

General Hals surveyed the scene and saw the errant *T98* midway down the eastern hill. It stood in midst of a rutted, reddish area where its various maneuverings had stripped the thin sod from the clay. Its wife had to be that curled-up bundle on thé ground; but the general assumed that she was

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still alive—*T98* attempted still to communicate with her in various ways.

At uneven distances from the tank lay the smoking wreckage of jeeps, patrol cars, and a fire engine. Men occasionally peered out from behind these feeble barriers.

The general made a quick decision and called Richards once again.

"Richards," he said, "is your jeep still working?"

"Positive on that, general."

"All right, Richards. Get the radio out of it. Then send it down the hill toward the tank."

"Roger on that, general."

"Wait a minute. While the tank's busy with the jeep, I want the men down here below me to get in there and drag the woman away."

"We may sustain casualties, general."

"Then sustain them," the general said. And he thought about the members of the press and what those gentlemen would write about a tank that penned love letters on plush suburban lawns with a flame thrower. The evidence had to be eradicated at the first opportunity. *Darling I have missed you more than I can say,* said a scorch mark just below the pool. Near the stable stood the words: *Our years together are my most cherished memories.* Another tell-tale message, below the patio, said, *Darling, wait. I am home.* And yet another, a little lower: *Why are you afraid of me? Why do you run from me?* The general put in a call for Air Force jets. He wanted napalm. The planes should assume a holding pattern nearby . . . He would do it—despite the bad publicity: he would wash this hill in fire. Better that—

Richards had done as ordered. The jeep appeared from the shadows of one of the mansion's wings and began a slow, throttled descent toward *T98.* It was driverless, of course.

The tank saw the jeep approach and swung its turret to take aim. At that moment men hiding in the cover of wreckage to *T98's* rear rushed forward. The tank was still enjoying the lovely ball of fire it had made of Captain Richards' jeep—a face of fire with a blackish crown of smoke that rose and mushroomed almost as delightfully as a tactical nuke—when the men grabbed the lady of the house and ran away down the hill.

The tank swiveled sharply and lowered its gun—but nothing happened. *T98* evidently, did not wish to harm its spouse.

"Sir. Sir! General!"

The general saw the pilot pointing toward the distant hills at another helicopter.

General Hals was a cool, precise, unflappable man. He was entirely like the faultlessly shaped mustache he wore, whose every hair he inspected daily and whose misdemeanors he corrected every morning, face close to the mirror, with a golden fingernail clipper. He knew that the approaching helicopter was none other than WTUV's "Eye in the Sky." Its cameras would be loaded for action. They

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would relish recording *T98's* effusions on video tape.

Despite the irritation Hals felt in that moment, he showed none of it outwardly. He called the Air Force and ordered napalm dropped. The Air Force was sorry. The special code word the general had used in ordering the strike could not be found in any of the books. Higher headquarters had been consulted but no response had been received. And under the circumstances the target area was under the jurisdiction of the state of California. The governor had not—

By the time the Air Force had rogered out, WTUV's "Eye in the Sky" had come, had seen, and was still taping. It had much to record. The tank had been stung by its wife's abduction and displayed its rage in a barrage of artillery. Shells leveled the mansion. Machine-gun bullets sprayed. Fire swept the lawn (obliterating, thank heaven, some of the tank's own words). The tank darted this way and that, attacking everything in sight—save only the wreckage where its wife lay sheltered by soldiers, sheriffs, and firemen.

The general decided it was time to put an end to it, and he told Richards to bring in bazookas.

The tank spent itself in rage, but inwardly it felt the throat-clutch of intense disappointment, impotence, and sadness. The bold adventure was over before it had begun, finished the dream! Could it have cried, the tank would have cried.

The night before, parked in the hangar with its mates, it had expected another night of pornographic dreaming, much like every other night before—to be followed in the morning by training exercises to teach it how to use this still unfamiliar and strange prosthesis which seemed so huge, clumsy, and lacking in proper means of communication. Such was the round of its life.

But then, to its puzzlement and delight, the compelling sex-bliss had stayed away. It had enjoyed the total stillness of utter leisure—and not just for a moment but for hours on end, recalling suddenly that life had been like that before, in a wheelchair. But now the stillness and the leisure were a blessing rather than a curse.

Toward morning had come the electrifying notion that it was no longer quite so helpless as in that wheelchair, long ago. It had means of locomotion—and of communication—at its disposal. It tried the engine—and it started. It engaged a gear—and it took.

Then the tank experienced a moment of emotion so strong and excruciating that it would have fainted had it been a body rather than just a packaged brain. It had a vision of its wife—that other being next to whom he had lived so many years, so thoughtlessly, taking her so for granted. And after the stroke he had not been able to say to her what he had wanted to say more than ever: that he loved and appreciated her; that his life with her had been a quiet

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but joyous time. All he'd wanted.

But now! Now it could undo all that. It could move and speak again, however clumsily. It could see her one last time before they shipped it out to Africa. . . .

So the tank had broken rank inside the hangar and had begun its long trip home.

And now the dream was over. She had not recognized it, had fled from it, had hidden her eyes from its frantically spelled messages. Well, the tank would die here on its own turf. After its moment of freedom, it loathed the thought of training and nightly bliss. It wished to die.

The bazooka teams arrived at last and after some dangerous maneuvers destroyed one of the tank's treads. With one track lamed and the other under power, the tank turned about its own center like a swirling maniac intent on digging a grave for itself in the gouged and bleeding earth.

Then came a shell that fastened on the turret like a fire leech and ate its way into the metal—a fizzing, sparking circle of voracious light and heat. Visual connections linking the tank to eyelets in its turret melted into dripping ends of wire. Finally the second tread was also shot away, and the tank was paralyzed.

Outside its shell sweating and anxious men prepared to carve holes into the metal using laser guns linked by cables to a power-pack mounted on a track.

Up above General Hals bobbed, dipped, and buzzed like a hungry mosquito scenting blood.

WTUV's "Eye in the Sky" had landed. The cameraman was taking footage from the edge of a temporary barrier made of strung-out fire hose and guarded by deputies and a stalking, grim-lipped Captain Richards.

The lady of the house babbled incoherently in a speeding ambulance. She lay on a stretcher covered by blankets. A young man in white squatted at her head.

The driver of the ambulance had the radio on. He listened to a country crooner finishing a song. *Pamper me with praises, ply me with love,* the woman sang. And then again, on a concluding note: *Pamper me with praises, ply me . . . with . . . loooove!*

The song ended and the announcer came on. "Now, folks," he said, "here's a public service message from the Department of Defense. The folks down Pentagon-way have come up with a new program for people with disabilities. The say it's a kind of dividend on all the tax dollars we spend on military research. The program is called Prostheses for Peace, meaning that the Defense Department will help people who can't see or hear or walk or such. And it's absolutely free. Mind, now—those folks can't guarantee a thing, but if you've got someone near and dear you want to help, call 800-717-9999 and they'll tell you how to file an application. What about it? Get off that old rocker, people—do something for Gramps and Granny,

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hear' That toll-free number again. Here it is . . ."

Back at the mansion the laser carvers had penetrated to the "package." They snipped through its connections and brought it out through the seared, irregular oval cut in the tank's side. The package resembled a mid-sized picnic cooler. General Hals had already landed in anticipation of this event. Men loaded the package into his helicopter. Moments later the copter rose and sped away, leaving Captain Richards to fend for himself against a swollen complement of the press.

The reporters clamored for explanations. Why had the driver come to this place? What did all those messages mean? Why didn't he get out of the tank? Was the driver the woman's husband? And was the driver still alive? What about that thing the copter had carried off? Classified records? Had the driver gone nuts? Berserk? What detachment was this, anyway?

To all this Richards replied by repeating monotonously that an official statement would be made at a later time. He had no authority. . . .

Then, inexplicably to the observers, airplanes appeared on the horizon, flying low. They came in. Napalm drums fell, burst, and washed the hill with fire. Richards, reporters, sheriffs, firemen, soldiers, and gawkers barely escaped the holocaust. The Air Force had found General Hals' code word at last and had hastened to obey his order.

General Hals, his exquisitely polished boots at rest on the package, communicated with the Pentagon by radio-telephone. He set in motion a series of phone calls all over the nation. Men less cool than he went to work on senators and congressmen, a governor, and the president of a TV station. In a pinch, the general reflected, he could even blind WTUV's "Eye in the Sky."

The tank's inertial systems had survived the battle. It knew itself in motion and guessed that it had failed. It had been deprived of its death. It felt devastated, cheated, and sank into a catatonic numbness.

The motion continued for a while. Then its character changed. The tank was being carried now by men—into the hangar, probably, into that bright yet gloomy expanse that, at this hour, would be empty: its buddies and comrades would be out on the range learning counterinsurgency.

Then the motion stopped and the tank felt it coming: an explosion of searing pleasure as electronic impulses of supreme delicacy began to stimulate selected neuron bundles in its brain. It copulated with a thousand women all at once. It disappeared into transports of delight. The dream of that quiet night and the difficult adventure out there, in the sunlight, visiting its own lost past, faded into an insignificant, pale, underexposed episode, the disintegrating, spiderwebs of memory. ■

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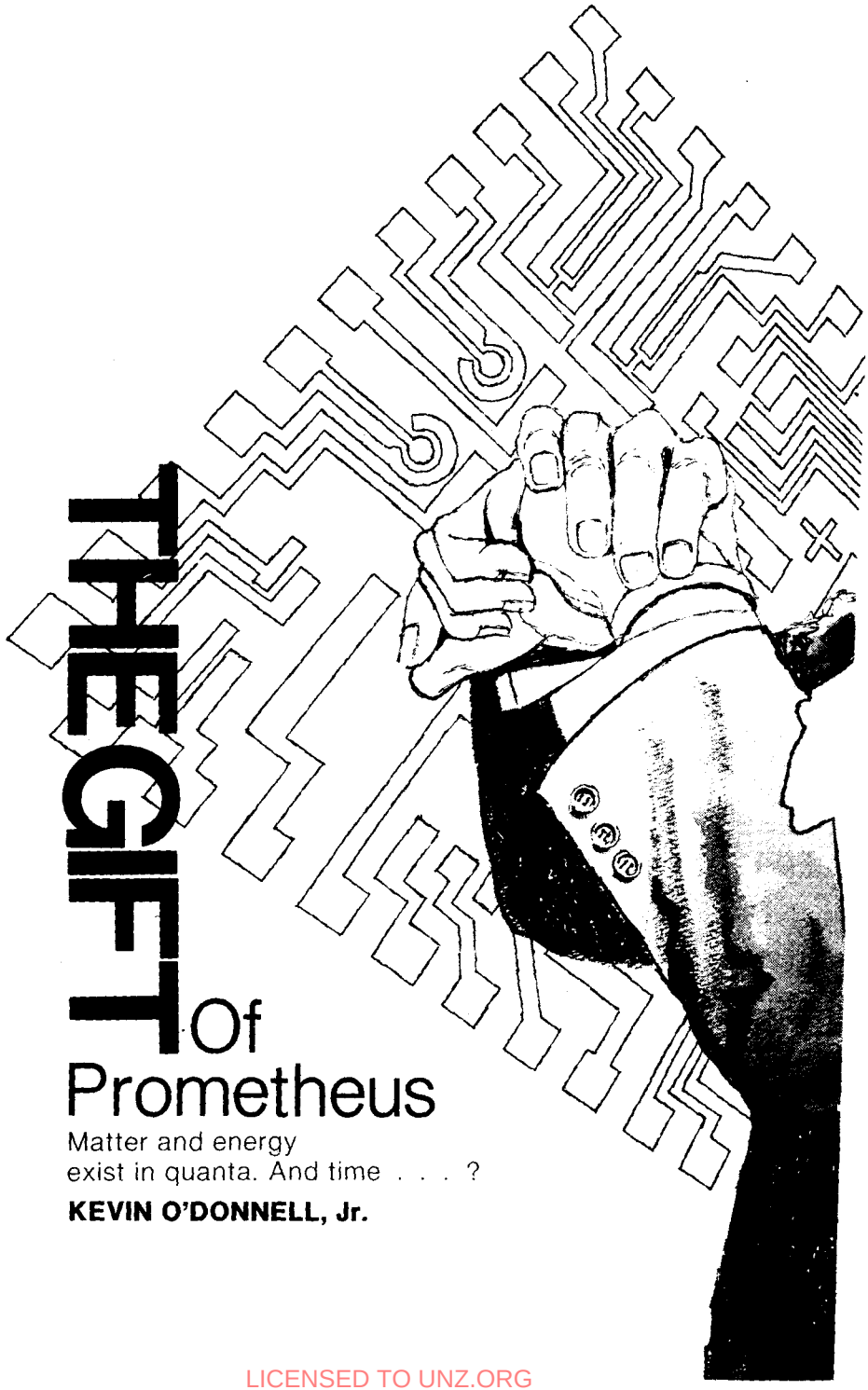

THE GIFT Of Prometheus

Matter and energy
exist in quanta. And time . . . ?

KEVIN O'DONNELL, Jr.

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Less than twenty feet away sits Porky, an obese, middle-aged demigod almost completely surrounded by hard-eyed Secret Servicemen. He's enjoying my act. It's spectacular, of course, but what he most relishes is the ego-puffing awareness that he, top man in his field, had only to snap his fingers to obtain America's best illusionist *gratis*.

His enforcers made it clear that my sole alternative to this command performance was a permanent stay in an insane asylum. They stressed the fact that it wouldn't have been the one in which they've institutionalized my wife.

For a President, Porky is sensitive. He basks in the hostility he's evoked. An enemy's apparent freedom on the White House stage threatens him safely, thrills him securely. Like a fake snake charmer with a defanged cobra, he knows that I dance to his tune . . . or else. That pleases him immensely.

You don't realize it, Porky, but tonight I pump venom into your veins.

The smattering of applause has died down. Bowing, I watch the digits change on the chronometer imbedded in my podium, and I sweep out my right hand. As if by magic—which is what I intend—a rose bud blossoms on my outstretched fingertips.

The spectators, too conscious of their importance to gasp, blink quietly. It's all an illusion, they whisper, as they concentrate on discovering the mirrors. It's a contest between me and them. What I do is not half as important as how I do it. Any respect I earn tonight will be for my skill in obscuring my methods.

If I'm truly skillful, they'll never know for what more they should respect me.

Nonchalantly throwing the knot of pink petals into the audience—where a Secret Serviceman intercepts and destroys it in his zeal to protect—I check the numbers on the tiny LED screen. 9:38:16. Slow count of three. Pivot abruptly. The blazing torch appears right where I thrust it this afternoon. I snatch it, and keep on whirling till my body no longer blocks it. This time, a Cabinet wife does gasp. I lift my arms high and, presto! Another torch flares in my left hand, provoking an awed "Shee-yit!" from the veep. And a flurry of .38 stares from the agents who will shoot me dead if I toss these flowers at the guests.

Moving very slowly—crew-cut Smythe-Trencher would love to blow me away; the jury's decision that I was innocent cost him a promotion, for which he's hated me ever since—I pass the burning brands to my assistant. A poor replacement for Kathy, Martha is nonetheless a lovely young blonde whose sequined Saran wrap bikini is neither large nor opaque enough.

Smiling, she holds the fires away from her prizewinning body. Porky brushes aside the intervention of a well-intentioned agent. As Martha turns to exit, stage right, I finger the

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outsized knot between her shoulder blades, the one that obviously fastens her glitter-glowing bra. With a wink to the Arkansas Senator who's come out of his bourbon coma long enough to ogle Martha's boobs, and after a hasty glance at the chronometer, I pull the string.

Praise me, ladies and gentlemen, because if it weren't for me, you'd never again see

A hiss and a flutter and a sparkle as the halter whispers down.

Then a rush and a plunge and a scintillation of two hundred silver dollars cartwheeling across the stage. While the audience's attention clings to the crashing, clattering coins, Martha scampers into the wings.

Perfect. She stood in exactly the right place; the coins I poured through the time-bracelet this afternoon seemed to stream through her cleavage.

The applause for that is fervent. Only the Arkansas Senator remains immobile, it's all he can do to keep his bloodshot eyes focused on the empty bra. I think he's waiting for me to fill it.

Tough luck, Senator.

I hate to interrupt them, but the second-screen is flickering and my next trick's coming up. Scheduled for 9:42:00 exactly, it's going to happen whether I'm here to cloak it in mystery or not.

Startled gawk at the ceiling. Reach into the spotlight's brilliant cone and grab the umbrella materializing there. Frantically pop it open above my head—just in time to ward off five gallons of water.

Oh, yeah, I've got them now. The veep has swayed to his feet and is beating his palms maniacally. Smythe-Trencher isn't happy, though. He *knows* that there's nobody—and nothing—upstairs, and growls into his lapel mike just to make sure. That pig's thought processes must be *bizarre.*

Got to keep Porky safe. The man's got enemies—lots of them—who don't understand that it was *necessary* for him to become President-for-Life. Why, without him, we'd still be at the mercy of those chaos-breeders who propagandize democracy.

Somebody will check. Fruitlessly. Sweat soaking through the armpits of his white shirt, he'll radio back a negative. He'll be told to look again, more carefully, and this time he'll probably tear his five hundred dollar suit as he crawls across the rafters. He still won't find anything. Unless he can travel through time, too.

This is more fun than I thought it would be. With many an occult gesture—is that the Chief Justice whistling?—I conjure up a plastic bag (shake it out), take two steps to my left (it appears to fill itself), and then—aha!—pluck an extremely startled goldfish out of the air. Drop him into the bag and he swims in confused circles: where did all those people come from? They weren't here when he dropped me through the bracelet a fin-flick ago. A master magician, thinks the fish.

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And he's right. Very soon now, a certifiably harmless man—one who's been stripped and frisked and probed a dozen times in as many hours, one whose every prop has been X-rayed, metal-detected, and disassembled—will consummate the assassination of a reigning Emp—excuse me, President. He will do it in full view of the world's most competent bodyguards. To all concerned, he will appear to be no more than an innocent bystander. His only regret will be that Kathy couldn't be present to savor his triumph.

Time for the cane. Behind the podium again, I raise my arms. Theatrically, I tug my starched cuffs halfway to my elbows. "As you will note," I intone, "there is nothing up my sleeve." The bracelet catches the spotlight and silvers it into a fuzzy band. "Watch closely, but remember: the hand is quicker than the eye."

HAH!

They're leaning forward. The chronometer says 9:48:28. One: waggle the fingers of the left hand. Two: grope amidst the squirming for the hard tip of the black enameled cane. Myself of this afternoon is on the other side, pushing it through to me.

I grasp it. Martha hits the tape that flourishes the trumpets. Ta-da! Out it comes, the full six feet of it, and they go crazy because it's the first time they've ever seen anything like it. And unless I pull off the main event, it will be the last.

It's all up to me. Nobody else knows that Porky, drunk and childishly enraged, will press the button tonight. Nobody else has seen the dawn break on mushroom forests that span continents. Nobody else has stepped into tomorrow.

Damn, but the cheering and the stomping sound good. Even Porky has deigned to respond.

His agents sit stonily suspicious, a bleak atoll in a jubilant sea.

They're waiting for me to do something—anything—that smacks of vengeance. Do they think I'm stupid? Revenge would be sweet, yes, but dangerous as all hell. I'd be too obvious to suspect.

If I hadn't traveled through tomorrow's sullen heat, I'd make sure that Porky's overworked heart beat till long after I was gone. I can't be motivated by their past, but only by their future. I've seen it. It is not.

Yet even knowing the dire necessity for action, I find it hard to muster the audacity. I have to draw on the hatred I've accumulated. If the Service's mood drugs hadn't turned Kathy into what they'd claimed she was from the beginning, I might be indulging in dither. I might be worrying about "morality." I might even lose us all through hesitation.

I bow, and the stiff white cuff slides down, masking the silver shimmer through which I work my magic. Hushing them, I announce the grand finale. I hadn't expected the show to last this long. Ah, well. I stride to the coffin, stage right; Martha to the one stage left. Both are raised high on spindly-legged trestles. We open

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them, lowering their sides to show the assembly that they are empty and innocuous.

Then she closes hers and I close mine. The chronometer reads 9:55:31; I must remember that. I climb inside and jerk the mahogany top into place. Stroking the bracelet, I go back—

The dim attic smells funny; its floor is prickly. I tiptoe around the boards that creak. If Mommy hears me she'll holler at me. I'm not *mocking Daddy. I just want to see what he shot that he thought was a prowler. But the bulletholes are lost in the shadows. I hunt till I get bored and then decide to go downstairs. Wait— Christmas is only seven days away. Bet they hid my presents up here. Open this box—hope she didn't hear that. What was it? A bracelet. Girl's stuff. Shiny. Take it to my room, the light's better.*

to 7:30 PM, at which time I deliberately left the White House to make this trick possible. I lift off the heavy top, get out, cross to the other coffin. I arrive to hear feet tapping on a half-lit stage, to see reflected in the mirrors the dusk-subdued splendor of my tuxedo. Grunting, I open the glossy container and crawl inside. Then I go forward.

Does the defendant have anything to say? You bet your ass she does, Your Honor. I've been framed. So was my husband, but even those twelve stooges couldn't be dishonest enough to convict him. The evidence was planted and forged, which we'd have proven if you'd let our witnesses

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testify. The only reason this came down is because when we played Washington, Smythe-Trencher heard me say that Porky's power-lust was killing this country. His paranoiac fanaticism magnified that spark into a conflagration. Let their madness pervert justice if you will, but paint a star on your ceiling, huh?

—to 9:55:36. I'm in the box, shoulders tight against its satin-covered sides. Martha's spiel seems blurred and far away: "Ladies and gentlemen, I must tell you that I, who have been Maestro Marchia's assistant for several years, blah, blah, blah." Then trumpets blare drums roll. I always wish I could see what's going on outside coil the muscles hope she's clear ready set silence GO!!! I thrust hard and fast, the coffin lid flies up, and the spot's got me cold. The audience is stunned and even Martha is shaking her head because she doesn't know how I do these things.

In the midst of the tumultuous, heart warming applause, Porky coughs. He stiffens and falls forward. "The President!" I shout, keeping both hands clearly visible and clearly motionless. They twist to look at him, just in time to see the gaping hole in his back spit blood onto the Louis XIV chair.

I hurry forward and drop down off the stage. An agent rears up before me, horror on his face and hatred in his cold eyes. He's already trying to figure out how to pin this on me. Shrewd man, Smythe-Trencher. He blocks my way. We bump. My hands are quick. His obscenity is my cue to kill the President. I touch the bracelet—

What happened? I was in the back seat of my Chevy with Estelle and I had my hand there *the first time ever she's usually—she said no, no, I said why not, she said I'm too young maybe a couple years, I said Jesus Christ wish it was '59 already. Crunch! Car's gone, Estelle's gone, I'm lying exhausted in the goddam gravel and my wrist hurts. What is going on? And just in front of me, that car smoking black grease into my face, how come its plates read 1959? Jesus I wish I was back with Estelle.*

—and am twenty-eight hours in the future, holding Smythe-Trencher's gun, the one he's reaching for yesterday at 9:56:30 p.m.

I pocket it while I remove the bracelet. Thank God I've only one more trip to take tonight; these are short hops but they sap my energy fast. It wouldn't look good if I returned and promptly fell asleep.

Five steps forward. Yes. Porky was sitting right *here*. I hold the bracelet a foot, maybe a foot and a half away from where his chest was. Thinking carefully, I set the bracelet for the precise time. Its mouth films over. I retrieve the gun and fire once.

"Very nicely done," says a strangely-accented voice. I whirl. Two men, both thin and dark-skinned, are standing behind me. I sigh with relief because dressed the way they are, they can't be Secret Service. The air sparkles, like dust in a strong light.

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Outside, the tossing trees freeze. "Don't worry," says the one who spoke, "the guard down the hall did hear your shot, but I've moved us out of time. He won't arrive until long after we've gone."

"Who the hell are you?" I demand.

"We're here to give you a time-bracelet."

"You're thirty-nine years late—I already have one."

"That's as may be," he says, "but we're going to give it to you anyway." He reaches into his purse and extracts a shiny band of metal, which he tosses to me. I catch its familiar weight. It's a duplicate of the one in my other hand.

"Why do I need two of them?"

"Put the new one where you can find it earlier."

"But—" It's too confusing. I don't understand what's going on. "Where are you from?"

"Here. But 140 years up the line."

"Oh—you mean . . . I see. But why?"

"To make sure you get the bracelet."

"Why?"

He sighs. "Must I explain everything?"

"Yes."

"All right." He glances at his silent partner, who shrugs. "We're historians, specialists in your era. For some years now we've been wondering how the planet survived nuclear proliferation. There's a theory of history, you see, which insists that every generation spawns at least one leader mad enough to risk total war. If that theory were valid, the world should have been shriveled by the warheads' fury. And yet it hadn't been."

"Because of me?" A warm glow suffused me at the knowledge that my nightmare would never gain substance.

"Apparently. The man you've just assassinated is certainly insane, which is why, once the time bracelet was invented, we traveled back to study his career. We saw him die. We deduced the manner in which it was done. Logically, it followed that you had to have obtained the bracelet from us. Since, of course, we didn't know how or when—although the presentation lay in our past, it had been accomplished by ourselves from our future—we searched until we located a time and place to which we couldn't transmit ourselves. Then, knowing that our future selves were there, we tried it at regular intervals until, finally, we had matured into the future selves who traveled back. So here we are, giving you the bracelet. A superb performance, by the way."

"I don't believe any of this."

"Frankly, we don't care." He touches his own, wider bracelet, and the air dulls expectantly. "We're about to turn the stasis field off, so you'd best ready yourself to return."

The bracelet blackens, then flashes silver again. Outside the quick-thawed trees whip at the window pane. Footsteps hammer in the corridor. The two men disappear. I posi-

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tion myself and emulate them, leaping to—

A nineteen-year-old experimenter, I am hunched on the edge of my bed, glancing at the stopwatch. Its sweep hand is still at zero. It must be wrong. Times does pass while traveling. I can feel *it; I can even remember, afterwards, the memories I relived during the journeys. And since the bracelet uses my energy as fuel, there must be a ▲t in there somewhere, because all definitions of energy incorporate time. Maybe standard measuring devices can't function between-times. Maybe the only gauge sensitive enough to note time's flight is the body that is being drained.*

—9:56:30.5. The gun slides inside Smythe-Trencher's holster effortlessly. Not knowing I borrowed it, not knowing the retribution it will earn him, he snarls, "Stay right there, reb. I know you did this, and we're going to find out how."

I nod, drowsy despite myself. I watch the veep become The Man; I watch the Praetorian Guard adjust its style to suit his own. Secret Serviceman #1 arrives, a tiny but ineradicable smile on his face. This penetration of the fortress at 1600 Pennsylvania Avenue will necessitate a larger budget.

The King is Dead. Long Live the King.

The world hasn't blown up. I've testified at Smythe-Trencher's trial, and I've read of his execution in the *New New York Times*. All the while the second bracelet has sulked in my suitcase, demanding that I deliver it to myself.

It's been two months, and my tour has brought me home. My feet, once freed, have led me directly to the house in which I was raised. It's red, now. It used to be gray. There are new owners, of course, people whom I've never met, but the thousands of posters clinging to street light poles have made my face familiar. They are willing to accept my explanation that once, long ago, I had a secret hiding place in the attic, which I have recently remembered, where I cached my father's heirloom pocket watch.

The lady of the house is a mother of three; wise in the ways of small children, she brushes back her graying hair and invites me in. Through alien passages whose dimensions are echoes of lost love, she guides me to the attic staircase. She leaves me there, knowing that they have no possessions worth a thief's while.

I don't avoid the creaking boards; in fact, to do so might worry the good lady below. Where exactly did I find it. Let's see . . . I close my eyes and orient myself; my compass is a childhood memory. In that corner, yes, where my father humiliated himself by thinking he saw—and by shooting at—a prowler, there was a box. The place is right. The time . . . ah, I found it the week before Christmas when I was six, which would be 1947.

Try December 10. The bracelet glows but I can't go back. The original

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I must have been within 50 feet of where I will appear, December 11, one "No. 12." Also no. 13 . . . 14 . . . 15— I burst, didn't I ever leave the house? . . . 16 . . . 17—

Bloody of nose, black of eye, I hear my mother say. Filippo, tell him that ruffians go to jail! So he approaches, looming above my thirteen-year-old shortness. Wha' happened? he asks. They were gonna beat up Jimmy, I was. I hadda help 'im. His calloused fingers lift my chin; his brown eyes are for once empty of laughter. You gonna make a career outa this, you better learn t' do it right, he says. Filippo, thrills my mother, why are you encouraging him? Sometimes, Maria, he says slow and serious, you gotta do what's right, not what's safe.

It's late at night, and even though I departed from a dark attic this blackness blinds me. I move, collide with a crate that clatters angrily, and curse to myself. I should have brought a flashlight, but I hadn't thought of it. I have a lighter in my pocket. Snap . . . snap, dammit, snap, snap . . . its wavering flame englobes me in yellow. I've not too far from where I discovered the bracelet. Two long strides, squat, funny, the damn box is stapled. I don't remember that. To hell with it. Get my fingers in between the cardboard, rip! Good. Now the bracelet lay it inside, interlace the corners of the boxtop so a board rasps behind me . . .

Rise and spin and a flashlight pins me, burning my eyes. Wincing, I half-turn my head and take a step toward— KAPOW! booms the revolver hollowly, KAPOW! sparks blaze from its barrel, KAPOW! get the hell out of here quick—

The bullet ricocheted off the bracelet and into my side. The delicate, super-sophisticated mechanisms are shattered. I am marooned betweentimes. My environment is hazy and diffuse; I do not know whether I am swaddled in fog, or whether the bracelet has thrown me so far in time that there is no longer (or is not yet) a physical world to surround me.

My blood neither flows nor clots. Brightly oxygenated red stains my shirt. The pain is intense, and never varies. It feels as though a white-hot spear has been thrust through my liver. That, or the hooked beak of a rapacious bird.

This is not fair! That I, who staved off the fires, who gave humankind a future, should be deprived of my own . . . if only the bracelet would fail completely. The parade would resume, I would heal, the agony would fade. But to be spread-eagled in time like this, to be permanently poised at the peak of my pain . . . there's no physical escape from it. Surcease comes only through submerging myself in memories. Even though I know, now, where their currents will carry me, when they inundate me I forget. I exist. I endure.

Less than twenty feet away sits Porky, an obese, middle-aged demigod almost completely surrounded by hard-eyed Secret Servicemen . . . ■

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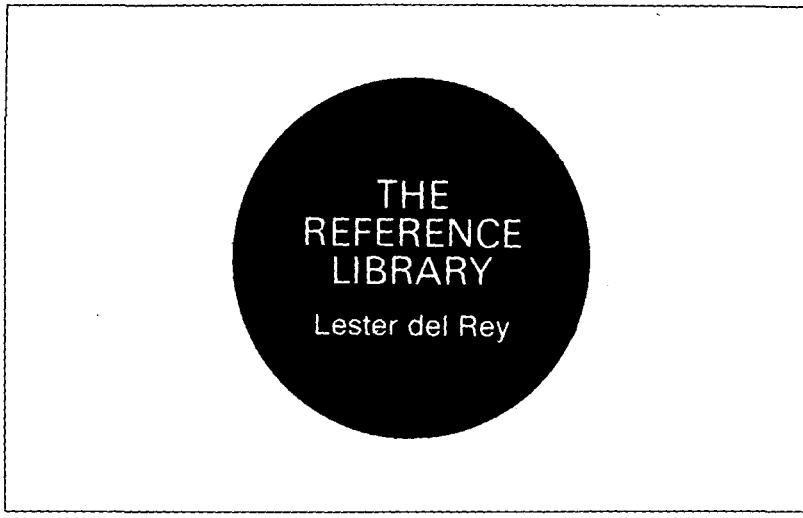

A SURFEIT OF SUCCESS: Maybe science fiction has become too blamed successful.

Most categories of fiction have a decently predictable life cycle. A few oddball authors have been writing books of a certain kind all along. But then enough readers begin looking for that category to interest some publisher to try them regularly. Eventually, other publishers begin using such works, and the boom is on. That may last for about a generation, but then the popularity of the type begins to wane. Pretty soon, we're back where we started, with a few books issued irregularly, sought by a few diehard readers.

Now surely, by 1976, science fiction should have been effectively dead on its fiftieth birthday. Instead, the number of books published that year in the category broke all previous records—which had already exceeded expectations. Nobody yet knows the number for 1977, but it's obviously a new record. And every indication is that 1978 will again be a record-breaker.

We've got DAW, Del Rey, and Berkley Books busily issuing new and reprint books every month. Avon and Bantam seem a little less sure of themselves, but certainly much interested. And now Ace has Jim Baen (formerly of *Galaxy*) as its editor and is planning to do more books than anyone else; they haven't done much recently except for reprints and *Perry Rhodans,* but this is going to change drastically. Dell, which has been rather inactive until recently, now has Don Bensen (who made Pyramid a major source of sf in the old days) to advise them; they're planning to become a strong, regular publisher of science fiction. And Pocket Books is paying high prices to build a full line of regular writers. This doesn't even consider the many publishers who don't

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have a strong market position, but will still be issuing more books than before.

I keep wondering about who is going to buy all those books. First, consider the bookstores. Some dealers are already beginning to worry about finding shelf space and tying up so much capital; they are going to continue stocking the proven lines, probably, but how many are going to keep on adding new titles indefinitely? And how many readers are there, anyhow? More than there were even five years ago, probably—but still, science fiction and fantasy are rather specialized in the demands they make on readers. (And that is true both of the lines that descended from the "old wave" and those that developed from the "new wave" stories.)

Also, where are the publishers going to find enough *good* science fiction, even according to whatever standard the editor may impose? Oh, there are plenty of novels submitted. But a lot of the books already being published are hardly worth reading. True, there are some very promising new writers appearing—but not enough to meet any greatly swollen demand. It seems to me that any further major increase in the number of sf books published must come as a result of decreased quality.

What happens when readers find it harder to determine which books to read, and when they find themselves increasingly stuck with stuff they can't enjoy reading?

Some of the lines with good backlists, stables of writers, reputations, and records of success are going to do well enough, I think, though they'll have to fight intelligently and vigorously for space and reader attention. And those writers who've consistently pleased the readers (if they don't try to cash in too hard on the boom) will continue to be read. But what happens to all the too-many others?

It should be an interesting period, at least.

Among the writers who seem to please a lot of readers most of the time is surely Gordon R. Dickson. His latest, **Time Storm** (St. Martin's Press, 448 pp., $10.00), is something of a departure from Dickson's usual work. It's based on a more complicated scientific gimmickry than he normally uses. (The first few chapters of this were discussed when I reviewed *Isaac Asimov's Magazine*, where they were used as a lead novelette. But the book goes far beyond that portion.)

The chief gimmick is given away by the title. Time has gone crazy, and regular time storms sweep the world—those storms involving the mixing up of different periods of Earth's history, past and future. Most of the people seem to be eliminated by such storms, but a few seem to be immune. Marc Despard is one of these, and he sets out to cross the country to locate his former wife—if she is still alive. With him are a girl and a leopard. But they've been caught in the storms, which have changed them. The girl is mute. The leopard is imprinted by Despard and totally devoted to him.

The novelette section was fine reading, but lacked an ending. The novel more than adequately supplies such an ending—in a sense, it provides two endings sequentially and satisfactori-

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ly. Despard begins to develop a sense about this whole time business—aided by a creature he finds in a "future" city. He begins to experiment with the effects of the time storms, trying to find some area of stability where human life can be reestablished. And he begins to pick up a group of followers. From there on, the story becomes first somewhat simpler and more normal for adventure—and then far more complex and far-reaching.

Actually, the novel seems to be two novels, one a sequel to the other. The first part is a good adventure story with a lot of inventive angles; the second is rather more like some of the old "cosmic" stories of one man against the fate of the universe—but better written than many of those were, fortunately. And since this book is far longer than the average book, you won't be too far wrong in assuming you are getting two books for the price of one. The first is small scale, the second vast scale. And about all that really binds them together are the pattern-reading ability of Despard, and a curious, almost subliminal sense that there are masks over everyone's countenance—and perhaps over the cosmos as well. Despard? Well, maybe the storm destroyed his former mask.

Some of the characters are fascinating: the girl, a subhuman called the Old Man, Porniarsk the Avatar, and above all, Sunday the leopard.

It's a complicated story—or pair of stories—but the real interest is nearly always focused by those characters, as it should be. I'm happy to recommend the book.

I'm not so happy about **In the Ocean of Night** by Gregory Benford (Dial Press, 352 pp., $8.95). This is the second novel in the Quantum Science Fiction Program, following John Varley's *Ophiuchi Hotline;* I don't know what that program is trying to achieve, but I can't find myself very impressed as yet with the results.

Benford knows science fiction and he also knows science, since he's a professor of physics. In his shorter works, he has proved himself one of the more interesting younger writers in the field. But so far, I haven't found his novels very satisfactory. There is a great deal of good material in this one, but the totality somehow isn't convincing.

There are three steps in the development of the novel, each dealing with an alien ship, and all related through the hero of the book, Nigel. In the first, which I consider the best of these steps, Nigel is an astronaut who is sent to the asteroid Icarus during one of its close approaches to Earth. Seems Icarus has been spouting out gas, like a comet; and that jet of gas is changing the orbit, threatening to send the little world into collision with Earth. Nigel is supposed to blow it up with a bomb. But he discovers an alien ship buried inside the rocky worldlet. And he determines to save some evidence of that ship, despite orders from Earth. It's a good section of the novel, well handled and convincing.

But then we skip fifteen years. Now working in the space agency, Nigel discovers that another alien ship is entering the Solar System. Here the story of Nigel's discovering the nature of the ship and his experiences with it are fascinating—but they're sur-

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rounded with too obvious "with it" sex for three, a new religion, and even a mysterious return from death that may be cleverly developed but somehow doesn't amount to anything in the long run.

And the final events begin when another ship is found buried on the Moon. Nigel is sent to help decode what the ship's computer still contains.

Don't ask how long the ship was buried in Icarus, nor how that happened—but it had to be a long, long time. And the ship on the Moon must have lain there for over half a million years. Yet both of those suddenly develop activity that leads to their detection in a twenty-year period during which the second alien ship comes calling. There's a kind of common reason for the ships—but having three pop up so conveniently in such a limited part of the time of their existence is a bit too much to accept.

The ending of the story adds a tribe of Bigfoot savages, some mechanical hypnotism—which indicates an amazing knowledge of human brain functions for a machine from the remote past that was built by aliens—and an ending that suddenly becomes very arty and full of symbolism.

A lot of the novel was published as short fiction in the magazines from 1972 on. That probably explains some of the trouble with the novel, since tying such material, written over several years, into a coherent whole is difficult. But for whatever reason, I found the novel hardly worth the effort of reading it.

There's only one way to describe **The Hostage of Zir** by L. Sprague de Camp (Berkley, 216 pp., $7.95); it's a new Krishna novel. And like de Camp's other popular Krishna novels, it's a wry and wacky story of a human forced to contend with the semicivilized and semihuman cultures of an alien world where Murphy's law always holds good, and nothing ever goes according to plan. You could call it sword-and-sorcery, since swords are buckled with a touch of swash, and human science is a sort of magic to the too-human but egg-laying Krishnans. But the adventure is always cockeyed.

This time, our hero-adventurer is a chap named Reith who was forced to take the job of acting as a guide to an ill-assorted bunch of Earthmen tourists—the first guided tour to be tried on Krishna. Of course, he knows little more than his wards, and has to develop his knowledge as he goes along, often inadvertantly; and he gets no cooperation from his charges as he gets embroiled in Krishnan politics, a willing young princess and a witch who expects a human to father her egg.

If you've read and enjoyed the other stories of Krishna, you'll want this one. If you haven't read any, this is a good one to start with.

Edd Cartier: The Known and the Unknown doesn't have much reading copy and doesn't need it. The drawings of Cartier can speak for themselves, as anyone who read *Astounding* or *Unknown* in the period between 1939 and 1953 should well remember. This is a book of some 130 of his illustrations, beautifully reproduced on fine paper, with nearly all the drawings dated and connected to the story they illustrated. It is published by

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Gerry de la Ree, 7 Cedarwood Lane, Saddle River, N.J. 07458, runs to 128 pages, and costs $15.00 by mail. The book is edited by Dean Cartier, Edd's son.

Cartier was above all a master of several things: grotesquerie, humor, and the very spirit of a story, as examples. He also drew aliens with a sense of anatomy that might be a bit exaggerated at times but always gave the impression that the alien creature could move and breathe and exist; the bones were there and the muscles attached properly, and the creature could function.

But Cartier was best known, probably, for his gnomes, demons, and such like. They were always so delightfully bad-tempered or insidiously charming in their depravity.

It's the perfect "coffee table" book, sure to delight and fascinate anyone who looks at it—even if they can't remember or never read the stories. Only 2000 copies—so buy it now!

So far, I've deliberately failed to review any book about the space effort that took us from embarrassment at Sputnik above us to putting men on the Moon in a few short years. I've never been interested in propaganda, so the early books were ones I could avoid; I never found the middle books to contain much more than was found in the newspapers; and I'm not at all interested in how men found or lost God in some of the recent books. But there is finally an honest book on America's space program that reveals so much that went on beneath the outward surface that I found it fascinating.

This is **The All-American Boys** by Walter Cunningham (Macmillan, 332 pp. and illustrations, $9.95). Cunningham joined the astronauts in 1963 during the period of the Gemini program. He was part of the crew on Apollo Seven, the first Apollo to be sent into space. He left the program in 1971, after having worked on the Skylab project. And in those eight years, he saw our whole space program and the men involved in it as no reporter could.

His book is remarkably honest, from what I know and from the internal evidence within it. The politics, the jockeying for position, the pettiness—those are shown clearly, but so are the dedication, the work and detail that made the trips to the Moon successful. The men in the book emerge from the mantles of publicity to be what they must have been, if they were to accomplish what they did. They become human, with both the good and ill that that must mean. And above all, Cunningham tries (and succeeds to a surprising degree) to make plain just what type of man was required for the missions that were flown. It's a book that is happily written to be both lucid and fascinating.

If you're looking for a whitewash or a smear, you'll have to go elsewhere. But if you really want to gain insight into the men, the methods, and the motivation of our flights to the Moon, this is the book for you.

I have a few minor disagreements with some of Cunningham's opinions about women in space and certain political angles. But that is only nitpicking. The book is remarkably good, and I give it my strongest possible recommendation. ■

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Brass tacks

Dear Mr. Bova.

I was just reading my May issue and was tremendously excited by both your editorial and Richard C. Hoagland's article, *Return to Mars*. I always liked the idea of manned missions, but dismissed it as too expensive. Now, I begin to wonder.

I also like the idea of a citizen's lobby for space exploration and technology in general. If all the science fiction fans who read this magazine were to write their Congressmen and the right government officials it would surely be noticed.

Unfortunately, it is all too easy for the average citizen to become bewildered by the bureaucratic maze that is the federal government.

This is where Analog can help by pointing concerned fans in the right direction. I would like to see a comprehensive list of addresses of the various agencies and offices that handle these matters. In particular, where do you write and who do you write to in trying to reach NASA?

I'm sure there are many other readers out there just as concerned as I am who would also like to see such a list. Anything you can do in this line will be a public service and will be appreciated.

KEVIN D. MARSH
307 Diana Avenue
Wauchula, FL 33873

You can write to your senator or representative for a list of agencies that deal with specific problem areas such as energy, basic research, or other specific *areas of technology. In NASA, the man to write to is Mr. Herbert J. Rowe, Associate Administrator for External Affairs, Mail Code L, NASA Headquarters, Washington, D.C. 20546.*

Dear Ben:

I just received the record, "Nightfall" . . . and enjoyed it so much I felt I *had* to write.

The adaptions and changes were just about the best possible, except perhaps, for the failure to mention the "colony" of men, women, and scientific information which was at least

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noticed in the story.

One more thing: I think "Aton" was overacting a bit at the end of the record (but then, I don't know *what* Lagashians do when they go insane).

And lastly, in the February issue of Analog, you asked for the opinions of readers (or listeners) about future records. I am all for any records you care to make, if they even approach the quality of "Nightfall." In fact, I even have a few suggestions. You could do a record of one of Spider Robinson's "Callahan's Place" stories, or you could do (and this is my personal favorite) "In Hiding," by Wilmar H. Shiras . . . and/or (my second choice) "Opening Doors," same author . . .

But whichever story you do, at least do one, OK?

TOM KEARNEY
718 E. 8th St.
Moscow, ID 83843

Thanks for the suggestions. What do the rest of you readers want to hear? How about a "Dorsai" story from Gordon R. Dickson's series?

Dear Ben:

My new subscription to Analog (generally I'd rather pick it up on the stands: a freelance writer has few better sources of news about his friends than your average good newsstand)—my new subscription, at any rate, began with the June 1977 issue. I have, quite deliberately, read hardly a word of it yet.

The stories, reviews, guest editorial, are, after all, scarcely the point. At any rate, I hope they're not the point: if this Special Women's Issue is meant to demonstrate that women write better sf, or even noticeably different sf, than/from men, we are in even worse shape than I think we are.

No: the point seems simply to create a Special Women's Issue, as noted in the May THINGS TO COME. And this is, I guess, a thing I can imagine a Western magazine, or even—though with much less justification—a detective magazine doing, as a sort of redress-of-balance, given the current Liberation (or course women are equal to men—which isn't saying much), and given the comparative scarcity of women in the same publication, or the same type of publication, in the benighted, chauvinistic, and probably brutal and semiliterate past. I don't think I'd like the idea—the creation of ghettoes doesn't seem to me to be a step toward liberation of anything, and I speak as a member of several overlapping minority groups—but I wouldn't object to it.

In sf, I object to it violently . . .

The proportion of women to men in sf seems to me to have been just about the proportion of women to men in the mainstream, over the last (say) fifty years. Even before—where Verne stands, we can distinguish the unsteady ghost of Mary Shelley.

I mean: Thea von Harbou (METROPOLIS). Leigh Brackett. C.L. Moore. Margaret St. Clair—Idris Seabright. Catherine deCamp. Carol Emshwiller. Kit Reed. Katherine MacLean. Judith Merrill. Go on—it's a long list. Ms. Moore signed with initials, but this, again, seems a personal crotchet; male authors do it, too, and the list of female bylines argues a lack of prejudice.

So now we have created a ghetto, a Women's Issue—to redress what? Seems to me Liberation has taken a

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big step backward, and managed to put women in sf into a ghetto for the first time in the history of sf. (Oh, and I forgot Kate Wilhelm, and, from out of the field, Shirley Jackson, and Ms. Dorman from this very issue. And we'll go on, make up yr own.)

LAURENCE JANIFER

[redacted] 76th St
NYC [redacted]0023

Oh, you hypocrite! Where was your conscience when we published our Special Mars Issue, a couple of years ago?

Mr. Bova

Having read your editorial (July, 1977) and Mr. Wood's science fact article, I feel called upon to protest. Analog has always been a magazine for hard realism coupled with imagination—not this "if the world were only nice" stuff.

The free enterprise system works, profits are neither obscene nor can they be excessive. The law permits the profits. The legislation to control prices creates the shortage. Oil refineries are not built here because legislation creates a climate making it more profitable to build them elsewhere. Likewise, the legislation controlling the price of natural gas created the shortage, not the gas company's salesmanship. Canada has maintained natural gas prices equal (energywise) with oil and they don't know what to do with the surplus.

As for how far solar energy is so superficially—question you have even read the newspapers carefully. I designed solar energy systems—they work. But the absolute best any of us can do makes the "free" energy so expensive it would require another tripling of our fuel prices (with no inflation) can make such systems economically competitive and then only for a portion of the load. That's why they are no help in the present crisis.

Mr. Wood's approach to nuclear energy is reasonable on the face of it, he has missed the fact that "good" men do not exist in measureable quantity since no society ever has or ever will reward such behavior—"imperfect men and women lusting after money and/or power," are the real humans—Mr. Wood's fault lies in applying biblical morality to them. In the end our free enterprise system works because it is suited to real people, socialism does not and cannot work for the simple fact that men require goals and rewards for their efforts, and while, "all men are created equal," is a sacred thought in this country, "under the law," must be appended for the phrase to make sense, for in truth—all men are created unequal.

No government has ever been efficient since the beginning of time, nor will any ever be efficient; why? Employees of government, by the nature of government, must restrict their output to "safe" decisions (or none, otherwise they become personally responsible!). No employee wants to lose a government position; it's either lucrative, (one way or another), or the ultimate in security.

Add all that up and you have the reason behind the quotation, "Nothing is so important that the government cannot ignore it." (Who wrote that?, he was brilliant.)

All the above may sound cynical but it is just a sketch description of our brothers in the real world and we

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should love them for being what they are. I object strongly to you as an editor putting them down, all the more since you did it in Analog.

ROY LARRY SCHLEIN
29 Bala Avenue
Bala Cynwyd, PA 19004

To comment on the points in the order raised:

1. Annual profits above 100% do seem obscene, and the major oil companies determined effort to squeeze out smaller competitors is far from salutory. Legislation is not causing the shortage; consumption *is causing it, and within another few decades there will be no petroleum available at any price.*

2. You seem to be comparing capital investment prices of solar energy systems vs. oil heating. Hang in there, as the oil disappears and innovative engineers bring down the cost of solar systems, the economics will reverse.

3. If no government has ever made daring decisions, how did we get to the Moon in less than ten years, from a flat start?

Dear Mr. Bova,

Energy is a world problem, not only that of the United States. All technological nations are feeling the bite of the declining resource of petroleum. I therefore felt obliged to offer some comments on your open letter to President Carter.

By all means, let's use the alternatives! There are numerous ways to harness tremendous amounts of energy. Admittedly, they are imperfect so far but the technology to make them workable must be used. Strangely, the world seems reluctant to engage itself in developing these new energy sources. Let's use them!

I cannot however condone the reckless haste towards nuclear energy. There are too many unanswered questions. Certainly, last winter you were enjoying the benefits of nuclear power, but at what cost? Were the wastes from the plant being disposed of safely? What was the effect of the waste heat on the marine biology in the area? Was the uranium brought to the plant (by commercial transport, perhaps a truck) in a safe manner? Is the plant truly guarded against sabotage? And so on.

Credit goes to Ed Wood for pointing out all the possible stages in the reactor cycle for radiation leakage to occur. There is a myopic tendency to merely look at the reactor building itself . . .

GLENN MACINTYRE
P.S. Just loved *After the Festival*!
32679 W. Sixth Ave.,
Mission, British Columbia,
Canada

To answer the questions about last winter's nuclear power performance in the northeast: (1) The wastes will be stored safely, but since the powerplants are refueled only twice a year, there have been no wastes to dispose of, as yet. (2) There has been no discernable damage to the ecology because of waste heat from the powerplants. On the other hand, this heat could be used to create new fisheries; it is not being so used at present. (3) Try sabotaging a plant and see how far you get before they pop you into the slammer. Finally, the past quarter-century of struggle toward nuclear power has hardly been "reckless haste!"

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A Calendar of Upcoming Events

3-7 January
Protostars and Planets Conference (IAU) at Tucson, Ariz. Info: T. Gehrels, Lunar and Planetary Lab, University of Arizona, Tucson AZ 85721.

5-6 January
International Conference on System Sciences at Honolulu, Hawaii. Info: Dr. Ralph H. Sprague, Jr., College of Business Administration, University of Hawaii, 2404 Maile Way, Honolulu HI 96822.

6-8 January
CHATTACON 3 (Tennessee regional SF conference) at Sheraton Downtown Hotel, Chattanooga, Tenn. Semi-relaxacon. Guest of Honor—A.E. van Vogt; Emcee—Arsen Darnay. Registration $5 through 10 Dec 77, $7 thereafter. Banquet $5 until 10 Dec 77, $7 thereafter. Info: Irvin S. Koch, 835 Chattanooga Bank Bldg, Chattanooga TN 37402.

13-15 January
CONFUSION PI (Michigan regional SF conference) at Ann Arbor Inn, Ann Arbor, Mich. Guest of Honor—Kate Wilhelm; Fan Guest of Honor—Jackie Causgrove. Laser light show. Registration $5 in advance, $7 after 25 Dec 77 and at door. Info: David Innes, ConFusion Registration, 3532 Terhune, Ann Arbor MI 48104.

22-26 January
Joint meeting of the American Physical Society and the American Association of Physics Teachers at San Francisco Hilton, San Francisco, CA. Info: American Institute of Physics, 335 East 45 Street, New York NY 10017.

30 August-4 September 1978
IGUANACON (36th WORLD SCIENCE FICTION CONVENTION) at Phoenix Convention Center, Phoenix, Ariz. GoH—Harlan Ellison; Fan GoH—Bill Bowers; Toastmaster—F. M. Busby. Attending membership $15, supporting membership $7. The big bash of the SF year. Fans and pros watch as the Hugos and John W. Campbell Award for Best New Writer are presented. Join now in order to be able to nominate and vote for these awards. Talks, films, art show, masquerade, and the like. Info: Iguanacon, Box 1072, Phoenix AZ 85001

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